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The Engineering and Mining Journal

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A Concert of Powers

The copper market as organized by Mr. Ryan is quite different from what it used to be. This may be freely admitted by everyone, as may be also the brilliant success of the producing interests under his leadership during the last year. Just how he has managed things is known only to himself and a few others, and they are not going to say anything about it.

Let us make haste to say that it is far from our thought that the rise in the price of copper to 17½c. has been wholly the result of manipulation. No, Mr. Ryan has not learned to lift himself by his bootstraps any more than anyone else, but he had the discernment of a favorable trend of conditions before anyone else did and was quick to direct himself accordingly. Manipulation no doubt played some part in the early stages of the advance in copper, but after awhile it became unnecessary; at least we think so, although the shadow of the delayed mine output always rises perplexingly.

But as to the altered conditions marketwise. The Amalgamated no longer holds an umbrella. The Guggenheims no longer become nervous and cut prices when their order book is not filled to their satisfaction. Other persons no longer pretend to be firm while they are furtively making concessions to sell their copper. These agencies now name their price asked and stick to it. If buyers don't want to pay it they may wait until they have to, picking up in the meanwhile such supplies as they can get from the independent agencies. The big ones are unconcerned.

This unity of action looks like a combination, but it isn't; undoubtedly it isn't. It is more like a concert of powers. There are not any treaties, but simply a working together because it is to the common interest. There seems to be a friendliness which formerly there was not, and a spirit of "one for all, all for one" that prompts an exchange of information and a unanimity in expression of opinion that was not of yore.

This is very fine, but of course not even such a concert of powers, if it exists, can buck successfully against economic conditions, as Judge Gary, among others, has learned. Even copper in process can not be indefinitely delayed. We shall be curious to see what will happen when stocks begin to accumulate again and it is desired to sell copper in large blocks, which condition is surely going to be witnessed at some time as the years roll on. Will the concert then cease and the most discerning interest snatch the market in the first of its downward course, or will altruism prevail and everybody cut together and while they are about it make some good slashing cuts like the Steel Corporation used to do? We confess to a feeling of curiosity.

The Sense of Proportion

How many times has the engineer gone to some mine offered for sale, possessing "an immense quantity of ore," and found only a tub-full, so to speak. The vendor may have been quite honest. The misunderstanding may have been due to his absence of sense of proportion. Never having seen a mine of a million tons of ore developed he had no conception of what such a mine looks like, of what amount of work such an ore development implies. That his few hundred feet of shafting and drifting could not possibly expose such a quantity of ore never occurred to him; nor did it to figure with pencil and paper that at 12½ cu.ft. to the ton there must be 12,500,000 cu.ft., or say a block of ore 25 ft. thick, 1000 ft. long and 500 ft. deep if it were all solid payable stuff; no horses or lean spots.

In prospecting and preliminary exploration the same absence of sense of proportion is equally likely to lead to disappointment. This was indicated in the extraordinarily lucid and valuable paper on "Geology Applied to Mine Examination,"

by Ira B. Joralemon, geologist for the Calumet & Arizona Mining Co., which was published in the JOURNAL of Aug. 10.

Speaking of copper deposits, Mr. Joralemon said:

When examining an undeveloped copper district, the first thing to look for is a widespread and thorough mineralization. Where there has been mineralizing action strong enough to form important orebodies, it is almost certain that this action will have had a great effect on the rocks over a large area. In the greater part of this area the mineralization is usually too slight to make commercial ore. It may take the form of pyritization with surface iron staining of a large mass of igneous rock or schist; of seams of copper-stained iron oxides in limestone; of interlacing or parallel veinlets far from a large vein, or many other forms. However promising the smaller outcrops may be, I consider it very unlikely that they will develop into great mines unless there is some such general mineralization. The Southwest is strewn with outcrops of rich ore or of fine gossan on which fortunes have been spent only to prove them gash veins or shallow surface deposits which have not paid the cost of development. There may be important vein deposits accompanied by comparatively little mineralization of the walls, with no smaller veins leading from the great one. In the case of copper deposits at least, it is safer to let someone else pay for developing such solitary veins. In all the great mining districts of the Southwest, the mineralization extends with decreasing strength for several miles from the center of the district. Without such general and thorough mineralization, I do not consider a copper property worth developing.

This has undoubtedly been the case of most of the great copper deposits. Consider Butte, Bingham, Ely, Morenci, Bisbee, Cananea, Miami, Ray, Santa Rita and many others.—All have displayed widespread evidences of mineralization by copper. Incidentally, let us remark that Mr. Joralemon's paper is one of the most practical contributions to the literature of geology as a guide to the prospecting for copper ore whereof we know.

Analysis with Rotating Electrodes

In the article on analysis with rotating anodes in this week's JOURNAL will be found complete drawings and specifications for a four-cell cabinet for quick analysis. To those chemists who have not adopted rotating electrodes, we advise consideration of the article. Rotating anodes will not save the chemist's time; as a matter of fact, it takes a little longer to hook up the analyses on a rotating case than on a plain. Nor is there any saving in power. Quite the contrary, but this item is negligible anyway in laboratory expense.

But what rotating electrodes will do is to get assays out with electrolytic accuracy, and wet-method speed, and more assays can be made per day on the same amount of platinum, no inconsiderable item considering the present price of that metal and the temptation it offers to thieves.

Cyanide Immunity

A generally credited belief is that those accustomed to the operation of cyanide works become more or less immune to cyanide poisoning. It is much more likely that one unaccustomed to cyanide gases would notice their presence sooner than one used to their presence, but it seems unlikely, in view of the known effects of hydrocyanic acid upon the human system, that any amount of accustoming would alter or lessen its action. The odor of cyanide, characteristic of cyanide works, is usually not sufficient to cause any great inconvenience or damage and it seems probable that one might get used to this odor and fail to notice it while one unaccustomed to it might find it disagreeable. At the same time, an excessive amount of this gas will be the cause of discomfort or actual illness even with one fully used to it.

The greatest inconvenience experienced in working about cyanide plants is occasioned by handling the zinc in precipitation boxes. This is likely to cause minute abrasions of the skin, and the entry of the cyanide solutions directly to the blood is likely to cause trouble either as sick stomach, headache or the appearance of the eruption known as "cyanide rash." The appearance of this trouble, however, has nothing to do with one's familiarity with cyanide but depends upon and varies with the individual. Some feel the effects quickly while others resist it for a longer time, but all eventually experience it when subjection to the influence has been sufficient to overcome the natural resistance. It is probable that there is no such thing as immunity, as hydrocyanic acid is believed by chemists to be one of those poisons to which immunity cannot be acquired.

The Copper Statistics for July

The copper statistics for July are particularly of interest inasmuch as for the first time this year they disclose somewhat of the real economic conditions. Several months ago we remarked that the refinery statistics would be a useless index of the situation until they began to show a monthly production of 135 to 140 million pounds. July showed 137,000,000 lb. production and an increase of about 6,000,000 lb. in the stock. This means simply that it has been useless or impracticable to delay the mine production any longer; and that the present American production is in excess of the demand for it at the present level of price.

The July production as reported dispels much nonsense that has been spouted, including the following:

1. That the refineries had been operated to the limit of their capacity.
2. That the hot weather prevented strenuous operation.
3. That the labor difficulties were still a disturbing factor.

Of course there was always an awkwardness in the discrepancy of the selling agencies telling their customers that the refineries were turning out every pound possible and the mine managers telling their stockholders of their magnificent increases in production, the additional dividends to come, etc.

The producers have profited greatly, but now find themselves confronted with an overloaded European market, a grumbling among consumers everywhere at the high price they have to pay, an increasing surplus both in Europe and America, an advance in the wage scale and the stimulation of many small producers that would have remained dormant if the price for the metal had culminated lower down. All of these are, of course, simply the natural concomitants of a boom.

Few have any conception of the amount of rock breaking that is always in progress within the city limits of Greater New York; just at present there is an unusual amount of such work in connection with the new underground roads and the new Catskill Aqueduct tunnel.

By the Way

"Plumbers and gasfitters have risen to the dignity of sanitary engineer," says the *Canadian Engineer,* "and the advance guard, who prepare the ground for a circus, class themselves as circus engineers. The profession is ever broadening."

A subscriber reports having received the following in the course of some correspondence regarding a position with a new smelting company: "We do not want a mettalurgust, we want a man who can smelt ores." The most peculiar point about a company so "practically" managed is that its shares, which formerly sold at about $1, are now worth 1½ cents.

No recent mining report has been so much discussed as J. R. Finlay's appraisal of the iron and copper mines of Michigan. It is still a favorite pastime of the mine valuers associated with brokerage houses to show how erroneous he was in his estimates of the copper mines. It is a matter of business among the owners of iron mines to show that he was erroneous about them also.

The soya bean crop is gradually ceasing to be a factor in the silver market. Formerly the crop was financed through Chinese sources and paid for chiefly in silver. Within the last two or three years the business has passed largely into Russian hands, and the crop is paid for in ruble notes, which now circulate freely in Manchuria. As the soya-bean crop this year is valued at nearly $40,000,000, the relation between beans and silver was fairly important.

The reason that window panes are whitened in a building not yet completed, is explained by a building contractor as reported in the New York *Times.* "We don't plaster them over with chalk to prevent the public from seeing the unfinished condition of the interior, but to keep the workmen from battering out the glass. Transparent glass looks just about as transparent as air to the man who is moving a wooden or iron beam in a hurry, and he is likely to ram the end of it through an expensive window, but when the glass is coated with white it becomes visible, and the workmen hand their material in through the door."

We do not anticipate any serious disturbance in the copper statistics from the wrecking expedition reported by one of our Canadian contemporaries. It states that a force is now at work over the hull of the old ship "Pewabic," which sank in Thunder Bay nearly 50 years ago. The vessel is 160 ft. below the surface and the divers are to work in what is referred to as an "iron man"—a steel chamber with projecting arms. The "Pewabic" carried in its cargo over 400 tons of copper; it is planned to bring this to the surface a few hundred pounds at a time on days when Lake Huron is quiet. Thus the "iron man's" job does not promise to be a very steady one, even if he prove competent to do the work.

A curious complaint was recently made to the Rhodesia Chamber of Mines. It was that in several cases negro laborers, who had worked on the mines and returned to their homes in Nyassaland, had taken with them cyanide of potassium which they had stolen and which they used to dispose of their enemies. In one case, seven persons had been poisoned in one village. Correspondence with the authorities produced no result, the members of the Chamber of Mines considering it impossible to prevent thefts of small quantities of cyanide, of which so much is used at the mines. So it will still be easy to settle one's enemies, and an invitation to drink from a returned miner will be accepted with caution in Nyassaland.

We noticed recently that a contemporary listed among its mining patents, one relating to a submarine mine. This presumably was for the benefit of its Turkish readers who are more in need of this sort of a mine than the rest of the world. There are submarine metalliferous mines in Cornwall, Newfoundland and elsewhere, but this was not the kind referred to in the patent specification, nor was it any of those that are struggling along under a great burden of water in their capital. Our contemporary now prints in its list of metallurgical patents a stamping machine. This we assume is for the information of its readers who wear top boots. The patent for the stamping machine is assigned to the United Shoe Machinery Company.

Wall Street people, not very easily surprised at the company men keep in speculation, have recently been staring at the strangest trio that perhaps ever came together in a joint account in the stock market, says the *Evening Post.* One is Baron Herman Jones, who named himself so in a Hoboken emergency and is much better known to New Street by his real name; the second is a proprietor of patent remedies, who, in his widely advertised pictures, holds up a finger and says, "There is hope," and the third is the man who led the army of tramps to Washington during the first Bryan campaign. They lunch and walk and trade together. They trade only in one stock, which is a copper stock. New Street thinks it knows which two will lose their money.

In a recent publication of the Bureau of Commerce and Labor is a reference to some "petroleum springs in Zante, mentioned by a Greek historian about four centuries before Christ." Reference to Herodotus shows the following: "I myself have seen pitch drawn up out of the water from a lake in Zacyntus. At the place I speak of there are a number of lakes, but one is larger than the rest, being 70 ft. every way, and two fathoms in depth. Here they let down a pole into the water, with a bunch of myrtle tied to one end, and when they raise it again, there is pitch sticking to the myrtle, which in smell is like to bitumen, but in all else is better than the pitch of Pieria. This they pour into a trench dug by the lake's side; and when a good deal has thus been got together, they draw it off and put it up in jars. Whatever falls into the lake passes underground and comes up in the sea, which is no less than four furlongs distant."

"One of the best informed men in the United States on the copper situation," according to the daily press, says: "Consumers of copper in this country are loaded up with business. Every mill that I know of is working to its utmost capacity, having not only all the business it can take care of, but more than it can handle, and from what I can understand this condition is practically the same abroad. There is no longer competition between the mills, for they could not take any more business if same were offered and consequently all competition is eliminated." It follows from this, of course, that if the manufacturers of copper are at 100% capacity and can't take any more business, it is useless for the refineries to increase their output. It is satisfactory to have one fixed point from which to figure. This is a warning to the little mines, just starting up to get a piece of the pie, to keep out. Your copper is not wanted, consumption being already at 100% of the possible.

With the heated season, comes this account of placer mining along the Jersey shore. An Asbury Park dispatch to the *Times* reports "a recovery of 90% of the assay value of the jewelry lost by guests of the Dunes Hotel which was destroyed by fire last month. Guests who suffered in the fire retained Edward F. Smith, a New York mining engineer, to search among the ruins. A sluiceway was rigged up, and Franklyn Hardcastle, Edward C. Miller, and John Carroll, sons of guests who were losers in the fire, were posted as watchers. Miss Schultz, a daughter of the proprietor, also volunteered as a watcher. The ruins were washed through three screenings. Several silver meshbags were recovered in which there was money, damaged but redeemable. Today a lavalliere valued at $1400 was recovered. Three days ago a diamond cuff pin was found, and yesterday its mate was washed out. Most of the ground has now been worked over, but there is still one corner to be searched." New York jewelers, it is said, have appraised the property recovered at $25,000. This, we presume, is a "sight" assay, or it may be that some of the jewelry belonged to an actress.

Utah Copper Co.

The Utah Copper Co., in its report for the second quarter of 1912, shows a copper production of 9,069,237 lb. for April; 10,068,336 lb. for May; and 9,234,465 lb. for June, a total of 28,372,038 lb. for the three months, as compared with 24,929,550 lb. for the first quarter. During the second quarter 1,503,884 tons of ore averaging 1.42% copper was treated, as compared with 1,299,315 tons of 1.435% copper for the first quarter. The Magna plant handled about 70%, the Arthur about 30, and the cost of production, after allowing for smelter deductions, and not crediting miscellaneous income, is given as 8.127c. per lb. The milling profit was $2,237,485, Nevada Consolidated dividends $375,188, and miscellaneous income $10,026, a total net profit of $2,622,699. Dividends of $375,188 were paid, leaving a net surplus for the quarter of $1,441,351. At the close of the quarter, no copper due for delivery from the refinery remained unsold.

During April the coarse-crushing departments worked at a disadvantage, owing to wet ore, and in June the tonnage of the Arthur plant was reduced, owing to installation of new and heavier machinery in the coarse-crushing department. The tenth section of the Arthur plant was placed in operation in May, the eleventh in June. All thirteen should be complete by the middle of August, when the heavy construction expense will be over. It is purposed to enlarge both coarse-crushing plants, to insure sufficient capacity in winter and wet weather to keep the plants running at full capacity.

During the quarter 1,589,648 cu.yd. of capping was removed. The Bingham & Garfield Railway hauled 10,203 tons of ore per day from mines to mill, and 1265 tons of other freight.

Spokane A. I. M. E. Section Meets at Republic, Wash.

SPECIAL CORRESPONDENCE

The fourth quarterly meeting of the Spokane local section of the American Institute of Mining Engineers was held at Republic, Wash., July 26 to 28, 1912. A party of 17 or 18 men left Spokane, July 26, and upon arrival at Curlew, Wash., were met by H. S. Richardson and W. D. Timm, superintendent of the Morning Glory mine near Republic. After a dinner, a meeting was held which was largely attended. Prof. Francis A. Thomson, head of the mining-engineering department of the Washington State College, at Pullman, Wash., delivered an address on mining conditions in Republic, with which he had become familiar during several visits for the purpose of making examinations of the mines and mills. Edward C. Morse read a paper giving much information relative to the recently completed San Poil mill and this aroused instructive discussion, particular interest being shown in the work of the Williams chain-hammer pulverizer, the first to be tried in the West. On the morning of July 27 a trip was made up Eureka gulch. The San Poil mine and mill were visited first, and then the Knob Hill mine. Luncheon were served at the "little boarding house in the gulch." In the afternoon the Surprise, Quilp, Lone Pine and other properties were inspected, some of the visitors descending to the 700-ft. level of the Surprise. On July 28 a visit was made to the Rathfon Reduction Co.'s small mill and later the Old Republic mine was visited, as was also the Princess-Republic mine. After a luncheon, a resolution was recommended for changing the name of the section to the "Northwest" section. In the evening the North Washington Power & Reduction Co.'s mill was inspected. On the morning of July 29, the party returned to Spokane.

Carnotite in Utah

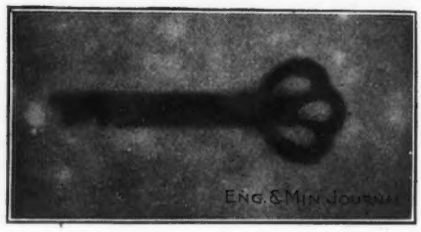
SALT LAKE CORRESPONDENCE

There has been much interest during the last year in the deposits of carnotite ore in Emery and Grand Counties. The industry is, however, still in the prospective stage, most of the deposits being undeveloped, and their size and value undetermined. So far there has been one producing property. Some development has been done on the Cisco group, near Richardson, on the Rio Grande Western R.R., and one car of ore has been shipped and sold to David Taylor, of Salt Lake City. The analysis of this shipment is not known. The property is not operating at present. Four men are being worked on a property owned by the Vanadium Ore Mining & Milling Co., 20 miles southeast of Thompsons. No shipments have been made. Rogers & Wade, of Moab, own a property near there, from which several tons of ore have been sacked. The assays are not known.

There are five groups of claims in the Green River district, one of which is owned by a syndicate, composed of Messrs. Lorimer and associates, of Philadelphia, and Angus Cameron, of Baltimore. This group is 10 miles southwest of Green River along the San Rafael Reefs, extending six miles. The property, operating steadily since Jan. 1, with 15 men, has produced 500 tons of shipping ore, a large part of which has been shipped and sold.

This ore is sold in Europe through David Taylor, of Salt Lake City, who has charge of all ore sales for the syndicate. No statement of analysis is given, except that the ore runs high in uranium and is highly radio-active. The ore occurs in lenses in Jurassic sandstone, and is mined by opencuts. The ore zone lies from 1 to 10 ft. below the surface, which dips nearly east about 15°. There is a well equipped laboratory on the ground, with offices, bunk house, dining rooms, etc., known as camp Vanura.

The Forsman-Ward group, the pioneer group of Utah, adjoins the Lorimer group on the south, and continues several miles to the San Rafael River. There has been practically no development. About 20 tons of ore have been shipped during the last three years, assaying about 1% U_3O_8 and 1% V_2O_5. No work is being done at present. The property is said to be controlled by the Philadelphia syndicate. The Morris property, consisting of a group of six claims, two miles south of San Rafael post office, is not operating at present. It has a surface showing, but no development has been done and no assays have been made. A car of ore has been shipped from the Lovelass group, to Doctor Van Arsdale, of New York. The property consists of a number of claims with small showings on several of them. No work is being done at present. The Temple Rock property,



RADIAOGRAPH MADE WITH UTAH CARNOTITE ORE

(The photographic plate was not exposed to daylight, but was wrapped in brown paper with the envelope containing the pulp sample of Lot No. —, and thus exposed for 111 hours.)

owned by Messrs. Beebe and Browning, of Castledale, Utah, is about 45 miles south of Green River, between Wild Horse Cañon and Temple Wash, about 15 miles from Hanksville. Ore carrying uranium and vanadium outcrops on the east and north for several hundred feet. Practically no development has been done here. Further around the mountain to the west an outcrop on the same horizon has been prospected by a 30-ft. tunnel, which shows 16 in. of ore at the portal, gradually pinching down to 3 in. at the face. On the west several iron blowouts, containing kidneys of a black ore carrying both metals, have been found. No development has been done here. Some samples are said to have been taken in the past, showing 1 to 3% U_3O_8 and 1 to 5% V_2O_5. This property is under long option to Angus Cameron and associates, and a part of the purchase price is said to have been paid. No shipments have been made, except for testing purposes. The ore occurs in Jurassic sandstone, and probably only in lenses.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Mining on Forest Reserves

I have just had brought to my attention a letter published in the JOURNAL of July 13, under the heading "Mining on Forest Reserves." The writer speaks of "The stupid and illegal interference of the Forest Service with legitimate prospecting." He then goes on to say:

"On heavily timbered land the Service should be careful to investigate fully and refuse patent, if there is a lack of good faith. On ground barren of timber or with scattering trees the prospector should have full swing so long as he has discovered a vein, no matter whether it is thin and of low assay value. This is the true interpretation of the law and there is no reason whatever why the claim should be protested, because he can show no deposit of actual value."

This is precisely the principle and the method applied by the Forest Service. In my annual report for 1911 I said with regard to this subject:

"On notification that patent to National Forest land is sought under the mining laws a forest officer makes an examination and, if he finds that the claim is apparently held in good faith for mining purposes and its location is such that the issuance of patent will not prejudice National Forest interests, his recommendation is favorable. When he finds that the claim is located on land valuable for its timber, or which has a high value for purposes other than mining, an examination is made by a mining expert to determine whether the mineral law has been fully complied with. Adverse recommendations are never made to the General Land Office except upon the report of such mineral experts."

If your correspondent can inform me of any cases in which the course which he advocates is not now being carried out, I shall be glad to learn of them. He says that "the mining papers should hammer away until relief is found"; but he sets up a man of straw to be hammered.

H. S. GRAVES,
Forester.

Washington, D. C., Aug. 7, 1912.

Rio Tinto Pyrites

In the JOURNAL of July 20, 1912, there appears a statement that leaching Rio Tinto pyrites cinder for copper is a departure in this country. Is not this what has been done for many years at Greenwich Point, Philadelphia, by the Pennsylvania Salt Co.?

In this connection it is interesting to recall that the plant of the American Copper Extraction Co., at Garwood, N. J., also leached pyrites cinder, although whether it treated only Newfoundland pyrites cinder or took in some Spanish pyrites I do not remember. This plant roasted the ground pyrites cinder in reverberatories with salt, leached, precipitated the copper on iron, and briquetted the leached residue for use in iron furnaces. The cement copper carried 80 to 87% Cu. The plant closed several years ago, but it is my impression that this was because of the effluent from the precipitation tanks polluting the nearby streams, and not because of any technical difficulties.

Reverting again to the Pennsylvania Salt Co., I believe that the leaching of pyrites cinder was regarded by it as so great an asset that most of the Spanish pyrites sold in the Baltimore to New York coast district for many years, carried the stipulation that the cinder should be returned to the Salt company, although this may be a piece of ancient history.

S. P. DAYTON.

Sudbury, Ont., July 27, 1912.

Melting Points of the Elements

There is a table of melting points of the elements in the JOURNAL of July 13, 1912, which is very interesting, but its arrangement (in ascending order of melting points) renders it difficult to use. I have recast it for my own use in alphabetical order, which is much more convenient. (The order is that of the chemical symbols, not of the fully spelled names).

MELTING POINTS (C°) OF THE ELEMENTS

A	—188	Gl	1800	Ra	900(?)
Ag	961	H	—259	Rb	38
Al	658.7	He	—271	Rh	1940
As	850	Hg	—38.7	Ru	>1950
Au	1063	I	114	S	116.5
B	2350	In	154.5	Sa	1350
Ba	850	Ir	2300	Sb	630
Be	1800	K	62.3	Sc	1200(?)
Bi	270	Kr	—169	Se	218.5
Br	—7.3	La	810	Si	1420
C	>3600	Li	186	Sn	231.9
Ca	810	Lu	not given	Sr	>Ca, < Ba
Cb	2200	Mg	651	Ta	2850
Cd	320.9	Mn	1225	Tb	not given
Ce	640	Mo	2500	Te	451
Cl	—101.5	N	—210.5	Th	>1700, < Pt.
Co	1490	Na	97.5	Ti	1900(?)
Cr	1510	Nd	840	Tl	302
Cs	26	Ne	—253	Tm	not given
Cu	1083	Ni	1452	U	near Mo
Dy	not given	Nt	not given	V	1730
Er	not given	O	—218	W	3000
Eu	not given	Os	2700	Xe	—140
F	—223	P	44.1	Yb	1800(?)
Fe	1520	Pb	327.4	Yt	1200(?)
Ga	30.1	Pd	1550	Zn	419.3
Gd	not given	Pr	940	Zr	1700(?)
Ge	958	Pt	1755		

For certain elements, As, C, Ca, Ce, Cr, Ge, He, Ni, O, Rh, Ti, and Zr, I have substituted values differing considerably from those in your table. These were taken from *Circ.* No. 35, Bureau of Standards, June 15, 1912. There are also a few minor changes of a few tenths of a degree taken from the same source.

A. A. NASON.

New York, July 29, 1912.

Efficiency Underground

Judging from observation and experience in different mines and from the small ability displayed by many miners and foremen, the mine offers a large field for the so called efficiency engineer. There was a time when I believed, like a great many other engineers, that the underground technique should be left largely to the practical mine foremen, and of course all such foremen agreed with us. They were jealous of "their rights," and I have often heard them severely criticize the manager or superintendent who would deign to tell them how to manage a drill, place a hole, or even say in what manner the cap should be inserted.

UNDERGROUND BOSS MUST BE TRAINED IN HIS DUTIES

There are some splendid mine captains, and to them we give due credit, and sympathize with them in all the problems that they have to face; for he who goes down into the mine, knows and appreciates the hard and arduous work of the conscientious and able foreman or shift boss. But if we are to get the same degree of efficiency in the mine that we get in other occupations, we must have our underground boss educated in his special duties just as thoroughly as the members of the technical staff are in theirs. It will no longer do to select as boss or foreman the man whose father and grandfather were bosses, because he was taught their methods. Certain of their methods were good, but many of them may be improved upon, and it is up to the technical man to go underground and teach the practical man, and not be taught by him. Of course, the technical man must be able to teach, and must have made a study of the particular problem in hand. He will have a hard task set for him and woe betide the scientifically trained man who cannot prove that his method is better than the one in vogue, or who shows awkwardness with drill, tamping rod or fuse. He must make a study of such an apparently simple operation as mucking, or pushing a car.

Many bosses and superintendents will not care to take this seriously. Let them pause and reflect. Have they any muckers or carmen that they would not part with? Why? Study their methods, rather than their results, and the reason will be plain. They are naturally efficient, and when their methods have been adopted by other men of the same class, that is, the method of a naturally efficient shoveler adopted by the other shovelers, the method of a naturally efficient carman adopted by the other carmen, etc., the result will be greatly increased efficiency.

I have seen foremen and superintendents who would discharge a good man because he displayed some ignorance rather than try to correct his fault. One of my foremen, who is now superintendent of a large mine in California, and is supposedly a capable man, said once, in speaking of a workman, "Why, that man said he was a miner, but he does not pull his ground." The miner in question was a hard, conscientious worker. Why didn't he pull his ground? Simply because no one had ever taught him how to put in a cut, and if this foreman had spent a few minutes with him every day he would have made a good miner of him. But no! Someone else must educate all his miners for him, it was his place to find fault. The trouble with such foremen and shift bosses is, that the end of the shift, one of the most important times to be underground if you really want to see what is going on, or see where so much of your powder is going, finds him at the mine entrance washing up or tallying the men or cars. A good underground man should know not only what men are underground, but where they are and what they are doing, and this he cannot learn from the outside. On one occasion, when I caught my foreman in the blacksmith shop at the end of a shift waiting for the men to come out, I went on into the mine and found the men just within waiting for the whistle. If the law prescribes an eight-hour day at the face, as it does in California for instance, let it be at the face and not at the mine mouth. Too many of us wink at this. Above all, whether at face or mouth, do not let your men wait after their work is finished. If by good workmanship they can finish their round satisfactorily half an hour before quitting time, let them do it and go home, but have them understand that the rule works both ways, and if they have trouble they must remedy it even if they have to work an extra half hour. When they understand the stint work it will usually bring good results.

The Mine Often Neglected

This desire to get out of the mine is not confined to bosses. How many superintendents or managers stay in their mines to the last hour, even occasionally? Many of us, consciously or unconsciously, evade this duty, for what we have considered more important ones, such as looking over reports, hearing complaints, giving instructions, etc., at the end of the day. Some of us have gone to an extreme in our bookkeeping department, and a great many reports are altogether too complicated for the practical underground man; he usually gets around it by filling in the blanks with what he thinks you want to see, regardless of its accuracy. I know of instances of this at one of the largest mines in the country, one at which the bookkeeping and reports are considered perfect. A simple form, well checked by different men, will secure the most practical results with the least labor.

It has been my experience that the best system of reports is the one that enables the man in charge to see from the reports, placed upon his desk the first thing in the morning, just what his departments have done the day before and where any weakness has been shown, so that he can go or send immediately to that place to correct the trouble, and these reports to be gotten out in such a form that they can, during the day, be tabulated by the clerks, for the books, daily, weekly, monthly and annual reports.

If the man in charge has to spend his time looking over reports at the end of the day, he will never think that he can break away for that last look underground. At this type of mine, the last hour of the day will see the whole executive force, from superintendent to shift boss, busy with paper and pencil, with no one underground to see how the miner is loading his holes, or how many feet he has drilled. It is much easier to write in some office, and if one's memory is rather tricky, who is to know?

A Mine Cannot be Managed from an Office Chair

We have men in the profession who think it perfectly feasible to run a mine from the office chair, and some of them have lived and died without knowing of the gross inefficiency that this system breeds, especially when it is applied to underground work.

I knew of two millmen at one of the big mines who kept tab of the not too frequent appearances of the "old man;" they left notes for each other, telling in detail of his movements and actions in reference to that department, they felt that he was neglecting it, but undoubtedly they were not aware of the demands made upon him. Perhaps some of these demands had better have been lopped off. The visits of his assistants did not call forth the same zeal from these workmen. The point is this, that it is well for even the "old man" to appear interested in the work of each man, and show himself occasionally. How will he keep his subordinates up to the work if his trips around are infrequent or more or less routine?

Is it certain that we cannot afford to have our good man right on the ground, instead of in some distant office? Are we sure that, if he is, he cannot save the cost of a good salary right out of his powder bill, or the extra efficiency of his men? If the mine under his management is organized as a great many of our mines are, always excepting those which have such splendid organization and efficiency that we all endeavor to imitate them, he will be a poor man if he cannot go into the mine and, by study, persistent effort and courage, save the cost of his own salary. Strong language, but it has been done; not once, but often, and I see no reason why it could not be done in more mines. In one mine that I visited they were burning carloads of dynamite bulldozing broken pieces of ore, which were as large as a small cottage. Yes, they had heard of the hammer drill, in fact had tried one, but did not think much of it. I will have to be shown why these same pieces of ore did not furnish an ideal field for a high-grade hammer drill.

Wanted Cartridges a Foot Apart

One meets with many queer experiences, and many interesting men, when going underground; some splendid men spend their lives there, but the freak is not unknown. Just the other day when I was criticizing a miner for leaving an air space between the bottom of the hole and the powder, and also for not getting his sticks of dynamite in close contact, he told me that a foreman at Angels Camp directed him to place his sticks of dynamite 18 in. apart in the same hole. Was this a grim joke of that foreman or was there really such an ignorant man in such a responsible position? I have at times seen and read of such ignorance displayed underground, that I am almost inclined to believe this foreman was a true character.

We pride ourselves on our milling, our inventions, our resourcefulness, and our mining work in general. Have we brought our underground work up to the same standard? From what I have observed I think not and it is my endeavor in this discussion, to make the engineer think harder, and look more closely, not to the machinery or equipment of this department, but to how the men handle this machinery and themselves.

A probable remedy for the lack of efficiency so often shown is to put a number of young technical men underground under a capable instructor and also under the supervision of the real man in charge. Let them get the knowledge. Let them make the efficiency studies. And then let them apply their studies, either by instructing the miners, or directing and educating such foremen as are willing to learn.

S. H. Brockunier.

Gaston, Calif., July 8, 1912.

Rapid Mine Tunneling in Arizona

By Norman Carmichael*

At the property of the Arizona Copper Co. at Clifton, Ariz., the problem of transporting ore from mine to mill is being solved by driving a haulage adit, the two legs of which are about 9000 ft. long and are connected by a mile of track crossing a flat between two ranges of hills.

*General manager, Arizona Copper Co., Clifton, Ariz.

Practical data relating to the driving of tunnels for various purposes and in different places are always of interest and many valuable papers have been published describing the driving of long tunnels for railroad, aqueduct, or power-canal purposes, where special appliances were adopted, specially trained workmen employed, and great speed attained as a result.

The following notes upon the driving of a mine tunnel may be of interest, not because of its length, for it was comparatively short, but for the reason that the results were attained in the ordinary course of development, without any special preparation or training of men and with none but the usual mine appliances. The object of pushing the work was to obtain data upon which to base estimates for the driving of a much longer tunnel in the same district.

Layout of Property

The Arizona Copper Co. operates the Coronado mine in the Clifton-Morenci district of Arizona. The mine is on the south flank of Coronado Mountain at an elevation of 5800 ft., and situated two miles from the Metcalf terminus of the Coronado R.R., a narrow-gage road seven miles long, with heavy grades, connecting Metcalf with Clifton, and operated by the Arizona Copper Co. for the purpose of transporting its ores from the Metcalf district to its works at Clifton. The Coronado mine yields principally low-grade sulphide ores, which are concentrated at Clifton. Transportation by the present methods constitutes a heavy item in the total charges.

The company also operates a concentrator at Morenci, with a capacity of 1500 tons per day. This was built to treat the ores of the Longfellow group, of which the Humboldt mine is the largest producer. The capacity of this mill will be increased to treat the Coronado ores, and the Clifton plant will be shut down.

The concentrator stands at an elevation of 5000 ft. The Coronado mine is situated three miles distant in direct line, and the Humboldt and Clay mines lie between these two places. The main, underground, haulage level connecting the Humboldt and Clay mines with the concentrator is at an elevation of 4660 ft., and a two-compartment shaft, 450 ft. deep, equipped with 5-ton skips, is used to raise the ore from this level to the crushing plant at the concentrator. By connecting this level with Coronado mine, a depth of 1140 ft. below the present adit level or 440 ft. below the present bottom level of the mine can be attained, and the transportation problem simplified.

This work, consisting of 9000 ft. of tunnel and 5000 ft. of surface grading, is now in progress and the work herein described forms one leg of the course, which is not in direct line, but commencing at the concentrator shaft passes north under the Humboldt and Clay mines and comes to daylight at the Queen mine (an oxide mine not at present worked) overlooking Chase Creek, thence following round the contour of the hills swings west and enters Coronado Mountain at a point near the foot of the incline over which the ores are at present transported from the mine. From this point there will be 6000 ft. of driving to connect with the mine shaft, and at least 6000 ft. more of tunnel to completely develop the ore shoots now being worked in this mine.

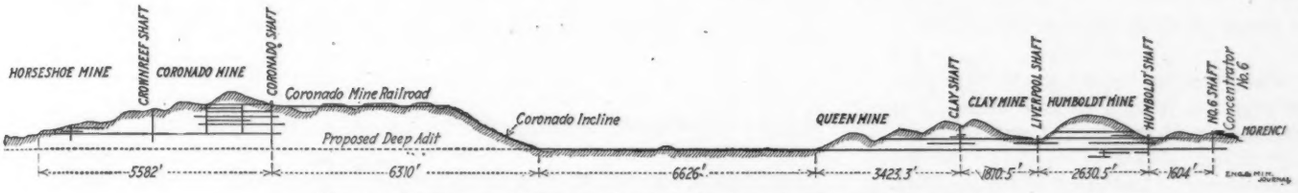


Fig. 1. Profile of Haulage Tunnel of the Arizona Copper Co.

Tunnel Driven at 0.4% Grade

In Fig. 1 is shown a longitudinal section of the ground passed through and a profile of the line; the grade is 0.4% in favor of the load. At the commencement of the period under review, regular mine development had connected No. 6 shaft with Clay shaft on the second level and the tunnel was being driven out toward the Queen mine and had reached a point 992 ft. from the shaft. As in most of our mine development, two shifts were worked, one for drilling, the other for mucking. The incoming heading from the portal of the Queen mine was being driven by hand, no power being available at that point; about 2400 ft. of ground remained to be driven through to make connection.

During December, it was decided to put on three shifts in the Clay heading and see what could be done in rapid driving. On December 26, the force was increased and warming up went on till the end of the month. The figures in Table I show the results obtained in this heading for the ensuing three months.

The best results for 31 consecutive days were obtained the last two days of February and the first 29 days of March, during which period 799 ft. of advance was recorded. Connection was made with the opposing heading at 6 p.m. on March 29. The nature of the ground was, on the whole, favorable, granite porphyry sufficiently hard to make good drilling and, for the greater part, to stand well without timber, only one shift's drilling being lost on account of having to stop to timber. Occasionally the ground would be tough and spongy and difficult to break. The best speed was made in the harder ground.

Tunnel 8x8 ft. in Section

The size of tunnel is 8x8 ft. in the clear, or a little more with the arching of the roof, the average section measured every 50 ft. giving 70.4 sq.ft. While the mines are supplied with compressed air from a central plant at the Humboldt shaft, the main compressor there is operated but one shift, and rather than operate it continuously for the sake of

TABLE I—PROGRESS IN THREE MONTHS DRIVING OF TUNNEL OF ARIZONA COPPER CO.

Month	Days	Feet	Average per day	Maximum day's work, feet
Jan.....	31	582	18.8	24
Feb.....	29	664	22.9	26
Mar.....	29½	762	25.8	35
Total..	89½	2008	21.3	....

one heading, we decided to install a small Sullivan compressor we already had, with a capacity of 332 cu.ft. of free air per min. at 5000 ft. elevation, and devote it exclusively to the purpose of driving this heading. This, we placed at the collar of the Liverpool shaft, 2500 ft. from the heading, and being supplied with steam from the hoist boiler there and attended to by the regular hoisting engineer, the arrangement was economical and satisfactory.

From the receiver at the compressor the air was conducted through a 3-in. reduced to 2-in. pipe to the face, and at a place near the face a small receiver was installed; thus, a constant pressure of 100 lb. was available for the drills; it rarely fell below 95 lb. when full drilling was in progress. The drills used were the Ingersoll-Rand No. C-110, size 2¾ in., weight 130 lb. Only three were used, one of which was always held in reserve near the face. The steel used was 1-1⅛-, and 1¼-in., with bits from 2¼-in. for starters down to 1½-in. for longs.

Although the air pressure was high, the repairs on the drills were light. Two of them were new and one had been in service for several months. The total cost for renewal of parts amounted to $210.14, or charge of 10c. per ft. of tunnel driven.

Short Rounds Better Than Deep Ones

Comparatively deep rounds were tried at first, but it soon became evident that the nature of the ground and the powder used (40% Hercules) favored shorter rounds and more of them. Thus, it became the practice to put in the back and breast holes about 4½ ft. and the cut holes and lifters about 5 ft. deep, breaking a full 4 ft. of ground each round. On some days when there was an opportunity to drill a seventh round the drillers would make the holes a little shorter. The number of holes drilled per round ranged from 12 to 16, as conditions required, the total number of rounds drilled being 499, with a total number of 7041 holes, giving an average of 14.1 holes per round.

Drilling was done from a cross bar with two machines, the first set-up being made on top of the muck pile from which the back holes, breast holes and cut holes would be drilled. This set-up was made about six feet above the floor of the tunnel. The bar would then be lowered and set up at about two feet above the floor and the lifters put in. On an average, about 175 pieces of steel were dulled per day.

Blower and Exhaust Fan Used for Ventilating

Ventilation was secured first by using a No. 6 Buffalo blower, electrically driven, placed near the Clay ventilating shaft, blowing fresh air into the face through 12-in. diameter galvanized pipe with joints wrapped with tarred muslin. This gave fair satisfaction, the men getting back to the face in from 15 to 20 min. after blasting. Later, when the heading reached about 1400 ft. from the blower, an arrangement was tried which proved successful; it is shown in Fig. 3. The blower remained as at first, a 12-in. suction fan was installed in the tunnel about 100 ft. back of the delivery end of the blower pipe which was arranged to draw the air from as near the face as possible through a 12-in. pipe and deliver it in the tunnel about 100 ft. back of the fan, or about 200 ft. back of the delivery end of the blower pipe, the delivery end of the blower and the suction end of the exhaust fan being, of course, extended as the face advanced. Had the tunnel been longer, the exhaust fan would have been moved forward occasionally rather than carry so much double pipe. The capacity of each of these fans was 950 cu.ft. per min. This arrangement facilitated the removal of the smoke and enabled the men to get back to the face in from 7 to 10 min. after blasting, thus cutting down the lost time 50%. In fact, I found it possible to return to the face immediately after the last hole had gone and remain there till the muckers had removed all the dirt, without feeling any bad effects. In 20 min. the tunnel would be clear of smoke back to the delivery of the 12-in. exhaust pipe, or from 1000 to 1200 ft. from the face, as the case might be. The fans were usually run for not more than one hour after blasting. The temperature near the face, when the machines were running, was about 75° F., and when not running, 80° Fahrenheit.

Muck Handled in Small Cars

Handling of the muck was accomplished by using small cars of 20 cu.ft. capacity, 30 in. wide over-all, the narrowness enabling us to keep double tracks close up to the face with six inches clearance between the cars and plenty of room to get around between the cars and the sides of the tunnel. Five or six hundred feet of double track was carried along, the switch occasionally being moved forward. Only temporary tracks of 12-lb. rails laid on 4x8-in. ties spaced five feet apart were used during construction; gage 20 in., as is in use throughout all our mines. Before blasting, four steel plates 4x10 ft. were laid in the face to receive the muck, these plates being held in place by a steel pin driven into the floor. These plates would overlap the ends of the tracks.

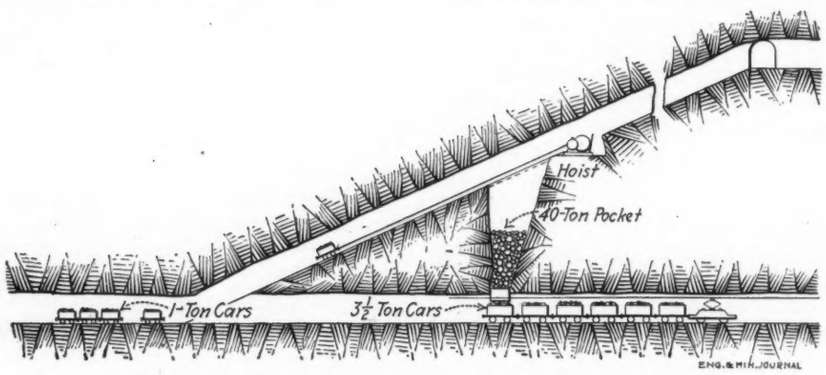


Fig. 2. Method of Transferring Rock from Small to Large Cars

Fig. 3. Method of Inducing Draft to Draw Off Powder Fumes

In practice, all the empty cars were run in on the left-hand track (looking toward the breast), and all the loaded cars were placed on the right-hand track; one empty would be run on to the plate and swung over to the right-hand side in line with the right-hand track; three muckers would then proceed to fill it, using short-handle, scoop shovels holding about 25 lb., the man in the middle throwing the muck over his shoulder, very little interference with one another being noticeable when work was in full swing. It required 80 shovel loads to the car, the car being filled in two minutes. An additional mucker stood on the muck pile and loosened and picked down the dirt so that the shovelers could easily get a full shovel, while a fifth man stood by the cars to clean the spills from under the wheels and to assist in pulling away the full car and to bring forward the next empty.

Cars Loaded at Rate of One in Five Minutes

These five muckers formed the regular crew, and changed off with one another in rotation, each taking his turn at the shovel. An average of one car filled and switched every five minutes was easily kept up, and often bettered. The total number of rounds blasted was 499, and the total cars of muck run out was 13,477, giving an average of about 27 cars per round. Thus, little more than two hours each round was required to get the dirt away. Six cars being filled, they would be hauled away by the mule; we had 20 cars in service so that no delay would occur.

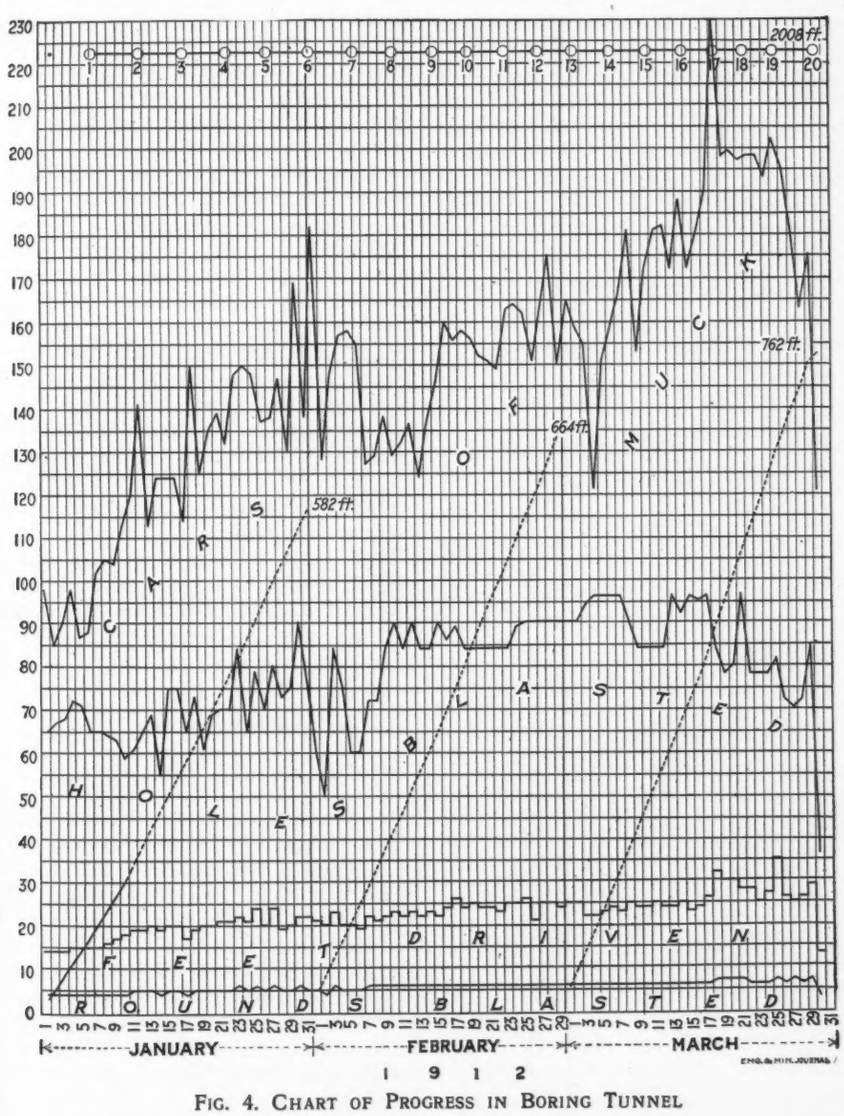


Fig. 4. Chart of Progress in Boring Tunnel

To facilitate the disposal of the muck, an expedient was resorted to which proved a great convenience. Our regular electric mine locomotives haul trains of 3½-ton cars and operate to a place near the Clay shaft. Mules and motors do not always agree, and we have sometimes found it to be disastrous for the former to mix them up in the same tunnel, and as it was not convenient for the motors to handle so small a car, nor was it desirable to have the small cars hauled too far from their place of service, an old incline raise and chute of 40 tons capacity was pressed into service and by a little alteration was converted into a convenient transfer, as shown in Fig. 3. A 5-hp. electric hoist was used to haul the small cars up the incline, and the hoistman attended to the hoisting, dumping and lowering of the cars. This transfer was 480 ft. from the face at Jan. 1 and 2487 ft. on March 30, giving an average haul for the mule and small cars of 1483 feet. When the muck was dumped into this chute the charges against the operation ceased, the waste being subsequently hauled away by the mine motor at such times as might be convenient and used to fill stopes or made use of where required.

The organization consisted of the following labor in the tunnel:

Shift	1	2	3	Total
Foreman	...	...	...	1
Miners	2	2	2	6
Machine helpers	2	2	2	6
Muckers	5	5	5	15
Mule Men	1	1	1	3
Transfer Men	2	2	2	6
Timbermen, pipemen, trackmen	2	...	...	2
Sundry Labor	1	...	...	1
Total	15	12	12	40

The following is taken from the daily log kept by the foreman, and represents the routine followed during the putting in of one round:

March 20, p.m.
2.00 Blasting of previous round finished.
2.10 Returned to face; miners picking down loose ground.
2.12 Muckers started cleaning up track behind plate.
2.17 Picking down finished. Machines and bar brought to face by helpers.
2.18 Started setting up cross bar.
2.20 Tracks cleaned up to shoveling plate.
2.21 Second car being loaded from plate.
2.25 Second car loaded. Air and water hose brought to face by helpers.
2.27 Center taken.
2.30 Bar set up and machines prepared for mounting.
2.38 Machines mounted and first holes started.
3.00 Shift changed; 100 cars loaded.
4.00 Top round of nine holes finished. Still some muck left in face. All hands turned in to throw back the muck.
4.14 Muck all cleaned up; 27 cars loaded. Muckers prepare to lay track and extend pipe and lay mucking plates for next round, etc. Miners take down machines.
4.16 Miners setting up bar for lifters.
4.26 Miners started to drill lifters.
4.52 Lifters finished. Tearing down machines and bar.
4.55 Started blowing out holes.
5.13 Holes loaded by two miners and fuses spit.
5.15 Air valve opened.
5.20 Blasting finished.
Total time, blast to blast, 3 hr. 20 min.

In the above round there were but 12 holes drilled as follows:—Three back holes, average depth 48 in., 144 in.; three breast holes, average depth 50 in., 150 in.; three cut holes, average depth 60 in., 180 in.; and three lifter holes, average depth 52 in., 156 in.; a total depth of holes of 630 in. or 52½ ft. The time of drilling the top round was 1 hr. 22 min.; the time of drilling the bottom round was 26 min.; total time actually drilling 1 hr. 48 min.

It required nearly a box of powder to the round, or 10.3 lb. of powder per ft. of advance. Comet fuse was used with 5X caps, and as the ground was dry, single fuse only was required, and missed holes were rare. The total time required fo muck 27 cars was two hours two minutes, or an average of 4½ min. per car.

Muck Not Thrown Far by Shooting

As a general rule, little of the muck was thrown back of the plates, or more than 20 ft. from the face, by the shooting. In the above case only one carload had to be shoveled off the track, and rarely was the pile more than 4 or 4½ ft. deep at the face. In the event of the muckers having cleaned up all the muck

before the miners had finished drilling from the top set up, the machine men would sit on the cross bar while completing the holes.

The air and water hose were carried over the heads of the muckers on four 6-in. cross pieces temporarily wedged in place. One helper acted as chuck tender for both machines, while a second looked after the supply of steel, bringing in sharp steel and removing the dull. In changing shift, no time was lost; the men were not allowed to throw down their tools, but handed them to the next man and the machine men likewise kept on cranking their machines till the new man relieved them.

A spare miner was employed to do odd jobs, such as drilling holes for the plugs carrying the ventilating pipes, cutting hitches, attending the surveyors, etc. Grade was set every 75 ft.; the foreman gave the miners center and adjusted the track to grade every time fresh rails were laid.

The accompanying chart, Fig. 4, gives the daily record of the work done. The survey for projecting the tunnel was done under the personal supervision of John Kiddie, the mine engineer. A closed survey was made by triangulation over the surface connecting the Clay and Liverpool shafts, carrying lines down to the level of the tunnel 600 ft. below the collar of the Clay shaft and 250 ft. below the collar of the Liverpool shaft, and meandering the tunnel; similarly over the surface to the portal at the Queen mine, from which survey the resultant course was calculated.

At the time of connection the heading from surface was in 400 ft., while the heading from the Clay shaft was in 3000 ft. from that shaft. The error in calculation of resultant course was negligible (approximately two seconds). The survey lines in the opposing headings projected to the point of connection showed a divergence of only ¼ in. at point of connection, while the grade was found to be correct.

Cost of Driving

In the costs given I think the present purposes will be served by including only the actual cost of driving and that of such temporary work as was incidentally necessary. About 300 ft. of the ground requires timbering permanently, and this work is now being done. The laying of the permanent track and equipping for electric haulage will follow, the cost of which will not be ascertained for some time.

The bonus system was employed, the men receiving regular wages and for every foot of advance made over 350 ft. per month a bonus of $7 was divided. This test was, as explained, largely experimental. The bonus was found to be excessive, but the duration of the test being short it was not reduced. The average earnings of the miners for the three months was $5.77 per day, and for the muckers $4.30 per day.

Effect of Bonus

With the results obtained, the following shows how the incentive furnished the men by giving them a bonus worth working for affected the labor cost per foot of tunnel:—350 ft. with no bonus earned, $10.78; 582 ft. in January, $9.131; 664 ft. in February, $8.739; and 762 ft. in March, $8.627.

The following is a statement in detail of the cost of the work, and in this connection it should be explained that the driving of this tunnel was merely part of the ordinary work of the mine and that while the labor performed in the heading itself and up to the point where the muck was dumped into the transfer chute was all chargeable to the job, there was much of the incidental labor on surface which through the card system was apportioned over other accounts in addition to the particular job under review:—

Labor:	Cost per Foot	
Foreman	$0 475	
Machine miners	1.651	
Machine helpers	1.063	
Muckers	2.814	
Mule trammers	0.862	
Transfer men	0.300	
Tracks and pipes	0.338	
Timbering	0.024	
Compressor, installing	0.135	
Compressor, operating	0.298	
Air drill repairs	0.044	
Shop labor	0.117	
Blacksmith and tool sharpener	0.238	
Installing and operating fans	0.135	
Surveying	0.149	
General	0.214	$8.857
Equipment and supplies:		
Air compressors, fuel	0.402	
Air compressors, water	0.030	
Air drills	0.072	
Air drill parts	0.100	
Air hose	0.021	
Air pipe and fittings	0.068	
Water pipe and fittings	0.062	
Water hose	0.014	
Ventilation, blower	0.031	
Electric fan	0.035	
Installation	0.106	
Galvanized pipe	0.086	
Power operating fans	0.052	
Explosives, powder	1.324	
fuse	0.088	
caps	0.032	
Candles	0.107	
Timber	0.126	
Hoist power	0.024	
Temporary track material	0.071	
Mules, depreciation	0.034	
Mules, feed	0.067	
Mules, harness	0.069	
Water	0.004	
Tools	0.008	
Lubricants	0.032	
Waste	0.006	
Muslin	0.002	
Sundry	0.007	$3.008
Total labor, equipment and supplies		$11.937

In connection with the matter of labor costs shown above, it may be well to state that since the work was charged in the regular way to mine development, there are a number of apportioned charges shown; for instance, one-fourth of the general mine foreman's wages is included in the charge for foremen. The wages for shop labor, compressor, air drill repairs, blacksmith and tool shop men and general were all apportioned by the regular card system.

The direct-labor cost against the work in the tunnel, consisting of machine miners, machine helpers, muckers, mule trammers, and transfer men, amounted to $6.89 per ft. (this included the breaking of the ground, mucking, tramming and transferring the waste to the chute), all the other work being accessory. Labor for timbering included above represents only temporary work.

In the foregoing equipment and supplies charges, in the case of air drills, 25% of their original cost was charged to the tunnel, and the whole of the cost for repairs. Similarly, 25% of the cost of both air pipe and galvanized pipe was charged to the tunnel, and 10% of the cost for fans. In the case of track material, a uniform charge of 10% of the value of the rails, spikes, bolts, splicings, etc., was charged, and 75% of the cost of the ties; 25c. per day per mule was charged for depreciation.

All the men employed, except the foreman, were non-English speaking Mexicans, Italians and Spaniards. No accidents of any kind occurred, with the exception of a slight one in the case of a Mexican, who was told by his compatriots to *"andale"* out of the way; that they were going to drop one of the mucking plates in place. He did not *"andale"* with sufficient alacrity and received the corner of the plate on his toe, which incapacitated him for a few days.

W. G. Scott, foreman of the Clay mine, was in charge of the operations above described, and the results attained were largely due to his careful planning of the work and the interest he took in every detail.

U. S. Arsenic Production

The production of white arsenic in the United States in 1911 was 3132 tons, valued at $73,408, against 1497 tons, valued at $52,305, in 1910, according to the U. S. Geological Survey. The arsenic was obtained as a byproduct of smelting operations. This output is much the largest ever made in this country, but owing to the low price and the distance of the smelters from New York, the freight charges absorbed a large proportion of the profit.

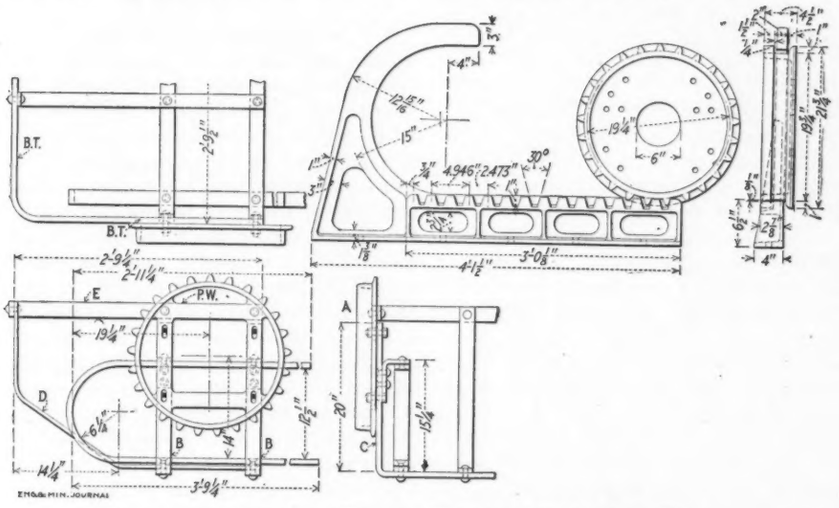
During the year 4996 tons of white arsenic, metallic arsenic, and arsenic sulphides were imported. Of this amount 1921 tons was white arsenic. The total production and importation in 1911 of arsenic and all arsenic compounds amounted to 16,256,000 lb. The principal uses of arsenic are in glass making, in pigments, and in insecticides.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Dump for Mine Cars

In the accompanying drawings are shown the details of construction of the dump or tipple that is used at the mines of the St. Louis Smelting & Refining Co. in the southeastern Missouri lead district, for dumping cars made with the wheels fastened rigidly to the body. This tipple is of the traveling-cradle type in that the cradle rides ahead on the framework before it dumps the car. The frame pieces on which the cradle travels end in hooks that catch the cradle and keep the car from going clear over; consequently, no reliance has to be placed upon a chain fastened to a crossbar of the cradle and anchored to a tie of the track or fastened in some other way to solid ground. This type of dump is somewhat more expensive than the type in which the cradle swings on its axle and does not travel forward.



DUMP FOR CARS WITH WHEELS RIGIDLY ATTACHED TO BODY

The frame on which the cradle travels is made up of two castings that are bolted to timbers running out across the chute into which the ore is to be dumped. The frame castings are made with horns that come up and hook over the wheels of the cradle so that it cannot turn any farther than desired, owing to the teeth of the wheels, which also mesh with teeth on the frame castings. These teeth do not carry the weight of the cradle, but simply mesh with each other, for the casting extends up to form a track ledge slightly higher than the tops of the teeth on which the wheels of the cradle roll. The function of the teeth is only to regulate the forward motion of the cradle wheels and keep them even as they go forward, as well as to limit the end of the dump when the wheels come flush with the hooks of the frame pieces.

The cradle is made up of the cradle proper and the cradle wheels which are bolted to it and on which the cradle rides forward and back as the car dumps and rights itself again. These dump wheels *A* are fastened by bolts that pass through slots in the cross arms of the wheels. In this way it is possible to level the cradle frame with respect to the dump wheels.

The cradle frame is composed of the two cross braces *B* to which the wheels are bolted and to which the track straps and wheel-catching loops *C* are riveted, as is also the center strap *D* which goes forward to fasten to the bridle strap *E*, that extends forward to catch the front of the car and take part of the strain that would otherwise come down to the track loops *C*, while the car is dumping. In case the cars will not right themselves after they have dumped, it is customary to fasten weights to the back cross strap *B* so as to remedy this. The track straps *C*, of course, extend back farther than the rest of the dump so as to join with the rails of the track leading up to the tipple. When the car has righted itself and the cradle has run back to its proper position on the frame, these drop down upon a cross piece of iron so that they just come level with the tops of the rails of the approach.

The dump that has been described is designed for a one-ton car of the usual type used in hand tramming at mines. The drawing gives the manner of proportioning the different members of the cradle and frame so that they will stand up to the strain of the work, but the dimensions of the cradle have to be changed, of course, to suit the dimensions of the individual car that they are to serve. The tipple shown in the drawing is made of cast steel, and has been in use for several years; it works satisfactorily. Some trouble has been experienced owing to the occasional breaking of a hook leg when a car has been run into the dump with more than ordinary force.

Hoisting on Inclines

By ARTHUR O. GATES*

In hoisting with skips from deep inclined shafts or hauling trains of cars from flatter inclines, the effect of the inclination is to make the pull on the rope less than the total weight handled. This reduction in rope pull allows greater loads to be handled, and the accompanying diagrams are for the purpose of determining at a glance the rope pull due to a weight of 1000 lb. gross when operating on the various angles and grades shown.

When a load *W* is supported on an incline, the actual support consists of two components, a normal force *N* at right angles to the track, and a force *P*, parallel to the track. The resultant of these two being, of course, equal and opposite to *W*.

The circle diagram developed from this relation is rather interesting, depending on a simple geometrical law which can be stated in several ways. Given a series of right triangles with a common hypotenuse, the intersection of the right angles will lie on the circle the diameter of which is the hypotenuse. Stated another way: If from any point on a circle, straight lines be drawn to the opposite ends of a diameter, the included angle is a right angle.

It will be noted that the gross weight *W*-1000 lb. has been plotted as the vertical diameter of the circle and is the pull *P* when the angle of inclination is 90°. At any other angle then 90° the pull *P* is measured by the distance from the lower end of the diameter to the intersection of the circle and the line drawn at the true angle, measured of course on

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the same scale as the vertical diameter. Thus with a gross load of 1000 lb. on an incline 47° from the horizontal the rope pull due to weight alone is 730 pounds.

On inclines the effect of friction of the wheels on the rails is to increase the rope pull when hoisting, and to decrease the rope pull when lowering. This friction or "traction" varies between certain limits; from 15 to 20 lb. per ton normal pressure on the track when track and skip or car are in the best of condition, up to 40 and 60 lb. and even more under bad conditions. This traction is proportional to the normal force on the rails and its value can be shown graphically by another circle diagram, this time with the diameter horizontal and equal to the traction on level grade as shown at the bottom of the circle diagram, the traction of 50 lb. for the 1000 lb. gross load (100 lb. per ton) has been laid off horizontally and the circle drawn. The length from the corner to the intersection of this circle and the angle line measures the traction for this inclination.

The combined rope pull due to load and traction is obtained by laying off a new circle on the hypotenuse connecting the ends of the vertical, gross-load line and horizontal, traction line, the incline angles being laid off from the bottom of the vertical, gross-load line. For the rope pull when lowering lay off the inclination from the upper end of the vertical, gross-load line.

The lengths of these lines to their intersection with the circle gives the rope pull hoisting and lowering as in Fig. 2, which figure also shows the partial loads due to ore only, skip or cars only, and rope. The circles for lowering rope-pulls of rope and combined rope and skip have their centers on the diameter of the big circle.

For a specific problem, lay off the different gross loads vertically as in Fig. 2, and the corresponding tractions horizontally, and the exact rope pulls may be read off directly to scale. In case the incline changes its direction, the rope must be divided into several parts, the weight of the section of rope nearest the skip and on the same inclination, together with skip and ore are combined on the circle diagram, and the pull of the rope on other inclines added. There are several ways that this may be diagrammed, but anyone familiar with the schemes as outlined need have no difficulty in determining rope pulls for any combination of inclines.

On the flatter grades, the effect of traction is more marked, so for purposes of accuracy that part of the circle diagram under 30° has been plotted to coördinate on a greater scale and which, we will call the coördinate diagram. Horizontal distances represent rope pulls when the gross load is 1000 lb., vertical distance marked above the curve indicating per cent. grade or rise in feet per 100 ft. horizontal distance; vertical distances marked below the curves, feet rise per 100 ft. along the incline. The angles every 5° are shown by dashed lines; intermediate angle may be found by interpolation.

The simplicity of the circle diagram and the ease with which it can be remembered makes one wonder if this method has not been used before, although no previous use of it has come to my observation. At any rate the curve shows how nicely the graphical method often gives a physical conception of the effect of variation.

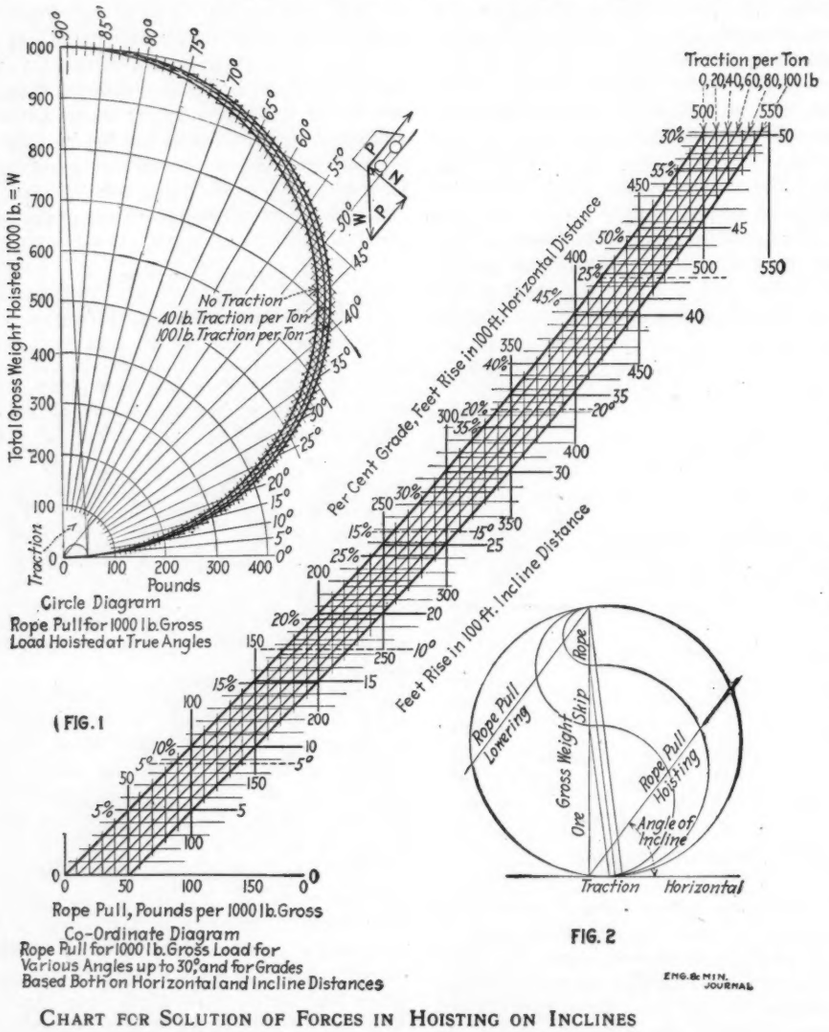

Total Gross Weight Hoisted, 1000 lb. = W
Traction
Pounds
No Traction
40 lb. Traction per Ton
100 lb. Traction per Ton
Circle Diagram
Rope Pull for 1000 lb. Gross Load Hoisted at True Angles
Traction per Ton
0, 20, 40, 60, 80, 100 lb
Per Cent Grade, Feet Rise in 100 ft. Horizontal Distance
Feet Rise in 100 ft. Incline Distance
Rope Pull, Pounds per 1000 lb. Gross
Co-Ordinate Diagram
Rope Pull for 1000 lb. Gross Load for Various Angles up to 30° and for Grades Based Both on Horizontal and Incline Distances
Rope
Skip
Ore
Gross Weight
Rope Pull Lowering
Rope Pull Hoisting
Angle of Incline
Traction
Horizontal
ENG. & MIN. JOURNAL

FIG. 1

FIG. 2

CHART FOR SOLUTION OF FORCES IN HOISTING ON INCLINES

Telephone Receivers

The application of the electric telephone to mining practice has been a distinct gain in saving of time and clearance in transmitting orders, and there is no doubt that owing to the promptness with which messages can be transmitted from one part of the mine to another, and to the surface, a good deal of value in money and in some cases, in lives, has been saved. It should not, however, be forgotten that for mining practice, especially in the heated atmosphere which is generally found in mines, working in the tropics, a certain amount of extra attention is necessary in order to adapt the design of the telephone receivers to the peculiar conditions under which they are operated. The miner is not always so careful as he might be, and there is great danger of damage due to rough usage being occasioned unless the instruments are made in a very sound and substantial manner. In addition to this a large number of telephone receivers have been scrapped or have become a nuisance, owing to the fact that the cases were made of ebonite or other composition. In the case of high temperatures they shrink so badly as to cause the cap to fall off. In some instances, it is found that the cap is taped on with adhesive tape, after which wax has been run in. Such methods of construction are of no use whatever, when applied to mining conditions. It should be noted by manufacturers of apparatus for mines that the case should be made of metal which should be protected externally by means of an insulated sheath in order that should the receiver be handled when ringing is taking place, the operator may be saved from the unpleasant shock which would otherwise be experienced.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Laboratory Agitating Apparatus

By Will H. Coghill*

Accurate laboratory cyanide tests can often be made in closed jars, but there are cases in which the results are misleading because the conditions are not similar to those in large-scale work.

Agitation by means of compressed air is also popular. Here again are weak points; the first is that the air is fouled in the compressor cylinder, and the second is that an unavoidable excess of air is used.

Though air filters have worked successfully in the air line on a commercial scale between the compressor and the

Laboratory Agitation Apparatus

agitator, they would be found cumberous in a testing laboratory. The evil effects of CO_2 where an unavoidable excess of air was used is shown by the accompanying table. A barren solution was placed in an inverted wine bottle with the bottom knocked out and air was forced in at the bottom (neck end) in an amount that would be necessary to keep pulp in suspension. The table shows how the protective alkalinity is gradually neutralized until the point is reached where the KCN begins to decompose, and the accumulation of K_2CO_3, one of the decomposition products of KCN under such conditions, indicates an increase in the protective alkalinity.

The KCN dropped from 4.8 to 2.7 in five days. In a duplicate test the air was passed through milk of lime, which proved to be a decided benefit. I next reconstructed the apparatus so that aëration and agitation was secured by means of a home-made air-lift pump. This consisted of a rubber hose leading from the bottom of the bottle to the top on the outside, this being connected by means of another hose to an air line carrying 25-lb. pressure in such a way as to make an air-lift pump. The pumping was at such a rate that the pulp would make a complete cycle every three minutes. This air-lift pump has worked nicely in practice, handling a four-to-one pulp. The deterioration of the cyanide solution in this apparatus was much less than in the apparatus previously mentioned.

RESULTS OF AGITATION BY AIR JET

	KCN %	Protective Alkalinity %
Mon.	4.8	1.1
Tue.	4.7	0.5
Wed.	4.5	0.1
Thu.	3.7	0.3
Fri.	3.1	0.5
Sat.	2.7	0.6

Wishing to get away entirely from the use of compressed air, I designed the apparatus shown in the annexed cut. I think that it is the only laboratory apparatus, except one patented and manufactured by Hendryx, in which there is combined aëration and agitation without the use of compressed air. Anyone can make one out of an abandoned bicycle wheel, some wine bottles, glass tubing, and a few inches of rubber tubing. The wheel is tipped about 15° from horizontal and geared to rotate at 6 r.p.m., thus dashing the solution from one bottle to the one opposite, 12 times per minute. The opening at the top of the bottles admits an ample amount of air for aëration and the agitation is thorough.

*Ore testing laboratory, Northwestern University, Evanston, Ill.

False Mortar Bottom for Increasing Height of Discharge

As the dies in a stamp mortar become worn, the height of the discharge is gradually increased, until it may amount to as much as a few inches less than the height of a new die. In order to compensate for the gradual increase in height of discharge, it is the practice in some mills to use a series of chuck-blocks. These are provided for each battery in sets of three or four, each being a little lower than the other, then as the die becomes worn a shallower chuck block is substituted; when the die becomes further worn, the third and still shallower chuck block is used, and so on until the lowest chuck block is used, when the die is nearly worn out.

In certain stamp mills on the Rand, instead of using chuck blocks of different heights, false bottoms are used in the mortars for raising the dies. These false bottoms, described by G. O. Smart, in "A Textbook of Rand Metallurgical Practice," consist of a steel plate about 3 in. deep, which is placed under the die in the bottom of the mortar-box cavity. As the dies become still more worn, another false bottom may be used, or coarse gravel may be placed under the false bottom, and thus both false bottom and dies may be raised.

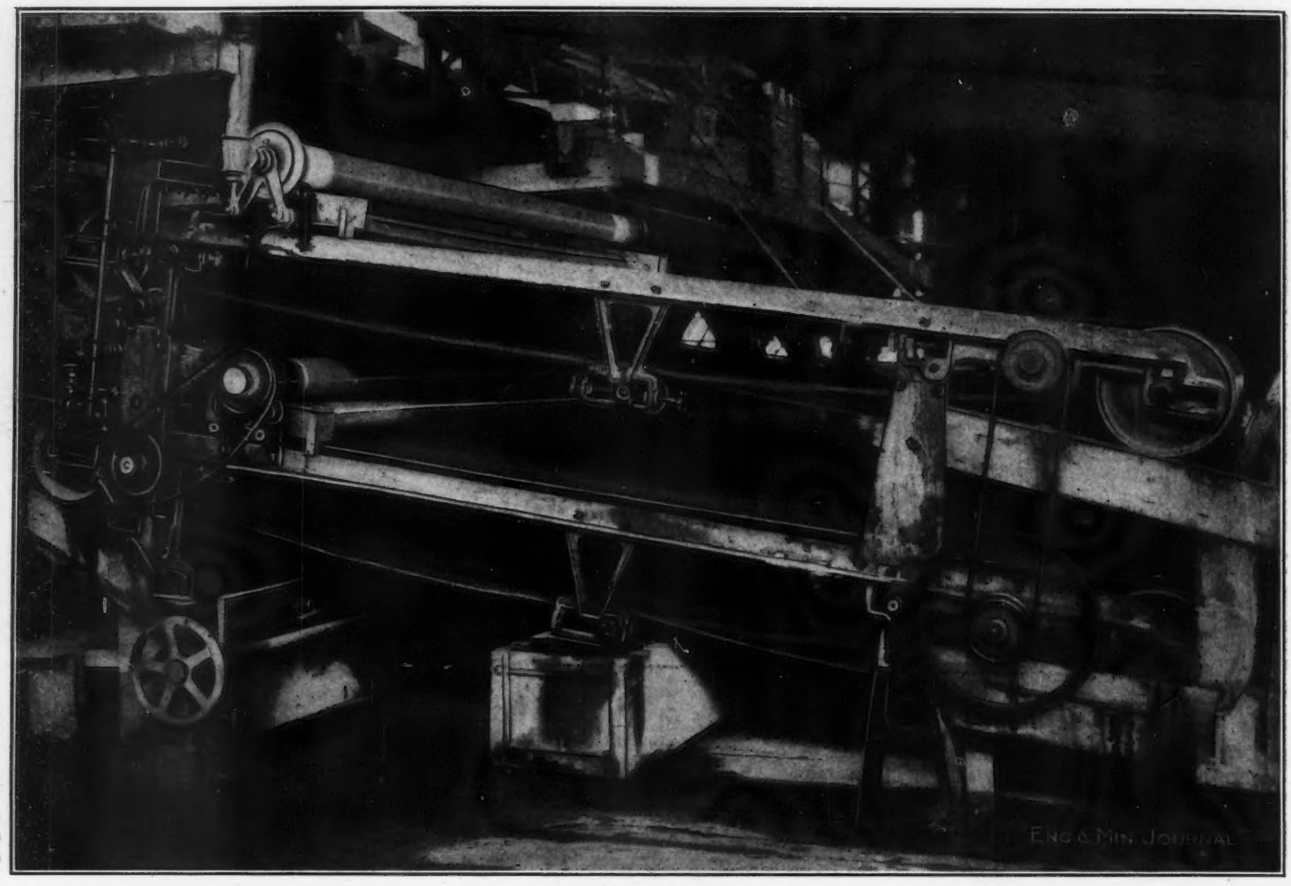
The use of a false bottom necessitates the removal of all the dies, while if the chuck blocks of different types are used, it is not necessary to delay crushing for so long a time, when compensating for the increase in discharge height.

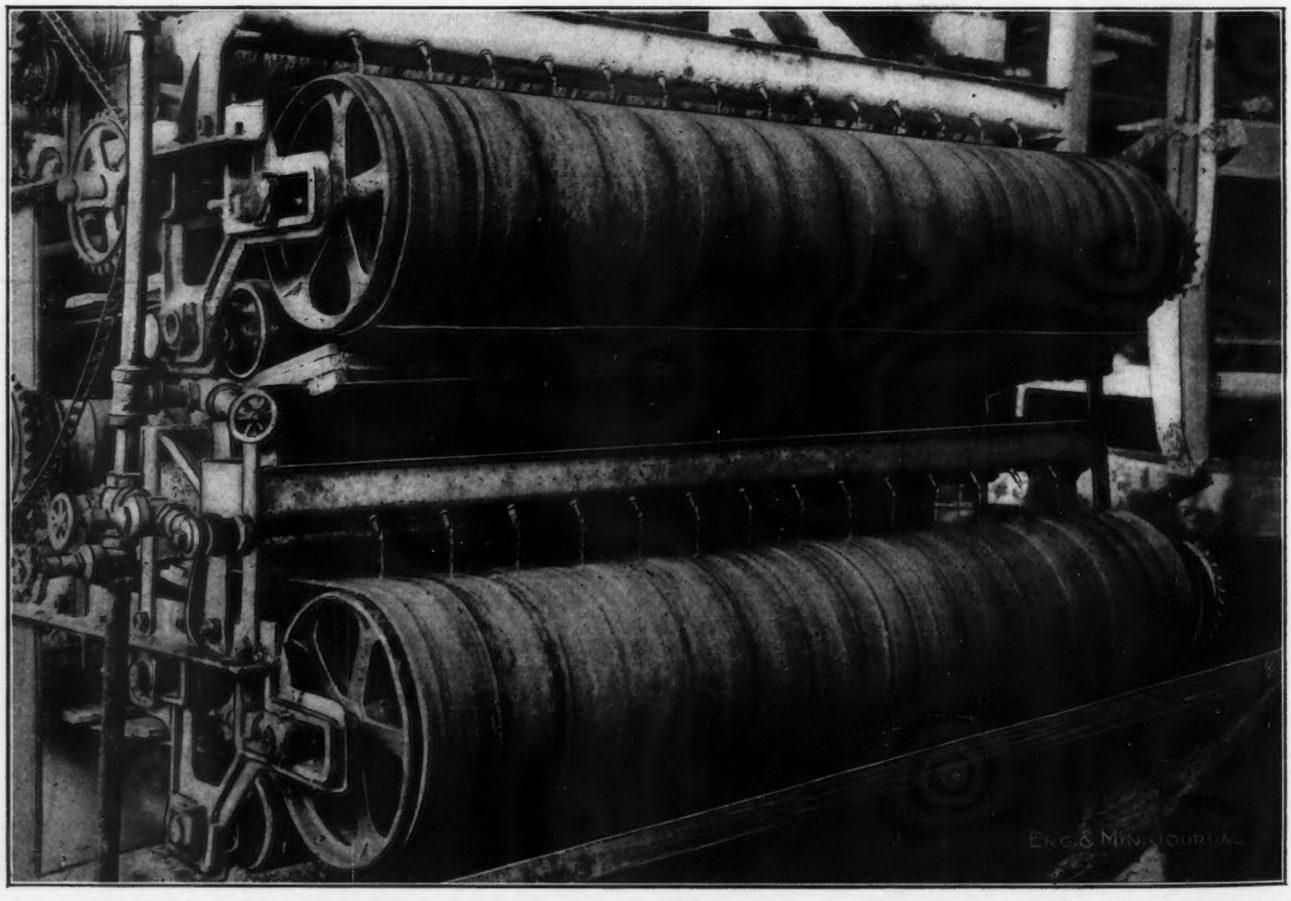
Nevada Consolidated Canvas Tables

The accompanying illustrations show the double-deck canvas slime tables now being used in the Steptoe Valley concentrator of the Nevada Consolidated company at McGill, Nev. The speed of the belt of this machine is approximately 7 ft. per min. and in the double-deck type of table, the low-grade concentrates of the upper deck are passed to the lower deck for retreatment. It is the intention of the management to work these slimers in decks of three; to take the low-grade concentrates from each deck and retreat it on a finishing machine. It is hoped thereby to get an insoluble in the concentrates of 50% as against the present average total insoluble of 65 per cent.

The machines are about 8 ft. wide and 13 ft. long and have a capacity of about 8 tons of solids per belt per machine per day. The feed to the tables assays approximately 1% copper and carries 18% in solids and the material is all finer than 200 mesh. The feed is material all of which has been discarded by the mill. The product of the machines treating daily 80 tons of solids containing 1% copper, has been amounting to approximately 14,000 lb. of copper per month, the concentrates having the following analysis: Gold, 0.073 oz.; silver, 0.21 oz.; copper, 5.7%; silica, 56.9%; iron, 9.2%; lime, 0.8%; alumina, 9.1%; and sulphur, 8.3%. The extraction is approximately 30% on a table of this type.

The material is used exclusively in claying up the reverberatories and as a smelter and converter flux and if, with some changes anticipated in cleaning the





SIDE AND END VIEW OF NEVADA CONSOLIDATED DOUBLE-DECK CANVAS TABLE

rough product, a reasonable extraction can be obtained with an insoluble of 50% or less, this material can go with the other concentrates through the roasting department.

Improved Teeter-Box Sampler

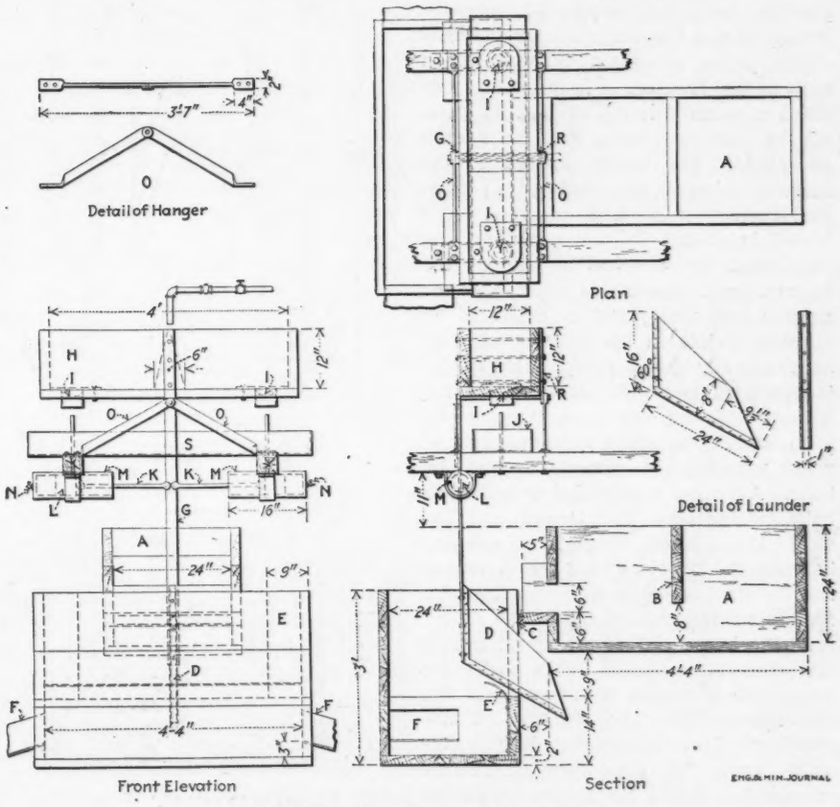
In the accompanying drawing are shown the details of construction of the teeter-box samplers that are to be used to sample tailings at the mill of the St. Louis Smelting & Refining Co., in the southeastern Missouri lead district. It was designed by G. A. Overstrom, the inventor of the Overstrom system of classification and the designer of the concentrating tables bearing his name. This teeter sampler is conspicuous in the refinements that have been added so as to insure the obtaining of a perfect sample. In the first place it has the retarding plungers and cylinders first used by William Carkeek, now dead, but formerly the mill superintendent of the Colorado smeltery at Butte, Mont., who was the first man to appreciate the importance of retarding the tilting of the teeter-box so as to insure the sampling spout traveling evenly through the whole section of the stream of tailings. This idea was transmitted to Mr. Burch and used by him in the design of the tailings samplers for the Nacozari mill of Phelps, Dodge & Co., in Sonora, Mexico.

In the tailings feed box *A*, baffles *B* are put in so as to break up the surface currents, while the feed is drawn off through a slot in the front of the feed box so as to insure a more even distribution as to depth of stream of the overflowing tailings. To the front of the discharge spout is fastened an angle iron that extends up high eough to dam back a layer of tailings on the spout and cause the tailings to discharge with a slight upward swirl at the bottom so as to mix the heavier particles with the feed while, by the angle iron, the discharge spout can be leveled so as to insure the same thickness across the issuing stream that is to be cut by the sampling spout.

This sampling spout *D* is made one inch wide so as to insure that it will take a reliable sample, less affected by impingement of particles upon the walls of the spout than is the case when the sample spout is made only about ½ in. wide, as is so often the practice, although another reason for using the wide spout is that the minimum trommel opening in the mills is 3 mm. The sides of the spout are made high above the top of the pulp stream so that there can be no flowing of the sample over the sides and loss of some of the slime. This is an important point that is not always considered in building teeter-box samplers. Below the sample spout, and on the near side of the catch box that catches the tailings so that they can be taken away without spilling in launders after passing the sampler, is nailed a piece of sheet iron arranged to prevent any splashing back of the tailings when they strike the bottom of the catch box. The tailings from the catch box are drawn off into the tailings launder through a slot *F* in the side of the catch box so that there is less liability of spilling tailings than if the tailings were drawn off from an overflowing lip.

The sampling spout is carried on the end of a long iron arm extending down from the teeter box. The teeter box *H* is supported from two timbers by the iron rests *O* that carry the bolt *P* that goes through both the hole in the spout arm *G* and that in the strap *R*, which is bolted to the teeter box by three bolts passing through the block that serves as the middle partition in the teeter box. In each compartment of the teeter box is placed a valve *I*. This, as the box falls, drops on the pin *J*. This pin then lifts the valve and lets the water run out of the box. The water discharges into the launder *S*, and is taken away.

Linked to the spout arm *G* are the two plunger rods *K* that connect with plungers *L*, in the cylinders *M* that are strapped to the underside of the cross beams that carry the supports *O*. On the ends of these cylinders are the pet cocks *N*. It is by the amount that these pet cocks are opened that the speed with which the spout cuts through the stream of tailings is regulated. The frequency with which the sample is taken depends upon the stream of water that is fed to the teeter box.



IMPROVED TEETER-BOX SAMPLER

Dust Determination by Filtration through Sugar

In testing air in the mines of South Africa, A. McArthur Johnston tried various filtering media, and after comparison it was decided that better results could be obtained with cane sugar than with cotton wool, glass wool, or water (*Journ.* Chem. Met. and Min. Soc. of So. Africa, May, 1912). The filter bed is obtained by coarsely crushing lump sugar, and using that which fails to pass a 90-mesh (0.006-in. aperture) sieve. The filtering layer is made about two inches thick and may require a copper or brass gauze to hold it in place. It should be slightly moistened, to aid in the retention of dust, but not sufficiently to cause caking. This point has to be guessed at.

To estimate the dust, after the air is aspirated through the sugar, the sugar is dissolved in distilled water, and then the solution filtered through a tared filter paper or on asbestos in a gooch. The weight found represents the total dust present. Incineration will then give a difference, organic matter.

The drill explorations in the Cuyuna district has disclosed what appears to be an extensive deposit of graphitic slate running upward of 20% in graphite by analysis. Experiments are being made to treat this material so as to save the graphite or to utilize the material for special purposes.

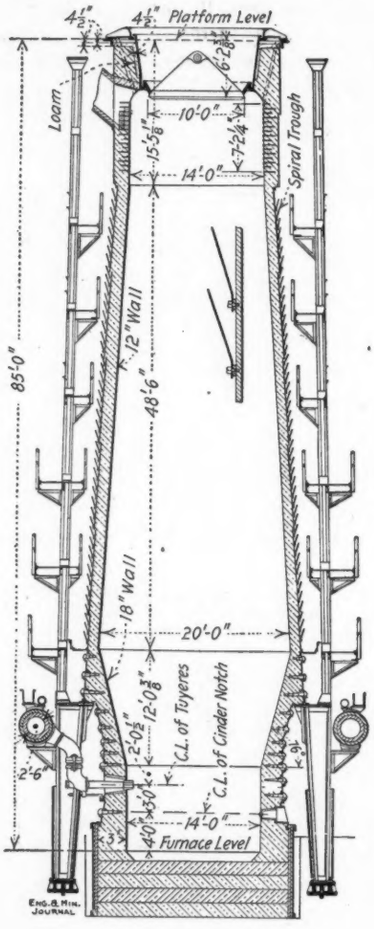
A New Thin-lined Blast Furnace

The construction of a blast furnace of the new thin-lined water-cooled type, which has recently been put in operation, is described in the Cleveland *Iron Trade Review*. This furnace was built for the Eastern Steel Co.—formerly Warwick Iron & Steel Co.—at Pottstown, Penn., by F. C. Roberts & Co., of Philadelphia. It is the third of a group of furnaces owned by the company, and is arranged to be used with the stoves and power equipment of either No. 1 or No. 2 stacks.

The stack is 85x20 ft. The framework, including the columns, is of wrought steel. The top platform, charging apparatus, etc., are supported independently of the furnace shell by columns resting upon the main columns which support the furnace. Platforms are provided at various levels so that all parts of the furnace casing may be readily accessible. The lower portions of the furnace columns are enclosed in cast-iron casings filled with concrete. The inwall is cooled by water carried and distributed by a spiral trough of the Roberts type. The waste water from the tuyeres and bosh-plates is delivered by different points in the spiral trough by an electrically driven pump. This trough is connected to the furnace shell by top bolts, which do not pass through the shell, thereby avoiding the possibility of water entering the furnace around the bolts. A washer is provided around each bolt and between the trough and the shell. As a result, there is an opening between the bottom of the spiral trough and the shell which is continuous, except for the interference of the bolts.

At the lower end of the spiral trough the water is discharged into a horizontal trough which in turn is connected to the drainage system. The construction and operation of the spiral trough is such that while some of the water circulates around the spiral a large quantity passes through the openings at the bottom to the courses of the spiral trough below and continues its flow to the horizontal trough at the lower end of the spiral. In passing from one course of the spiral to that underneath, the water is in immediate contact with the furnace shell, thereby forming a thin film over all of the plates. The effect of a well-distributed spray is thereby secured with the additional advantages that the side of the spiral trough prevents the wind from interfering with the distribution of the water.

The bosh is enclosed entirely in a wrought steel casing having openings for the insertion of the bosh-plates. The construction is of the Farrell-Roberts type. The bosh-plates are held securely in position by angles on the inside and outside of the steel casing, the former angles being above and the latter below the bosh-plates. The steel casing enclosing the bosh extends downwards to a point below the top of the hearth jacket and is provided with openings for the tuyeres, cinder notch and the row of bosh-plates below the tuyeres. The hearth jacket is made of wrought steel plates which enclose a series of water-cooled cast-iron plates. The furnace mantel is simple in construction and a continuous wrought iron casing is provided which extends from the top of the



THIN-LINED BLAST FURNACE

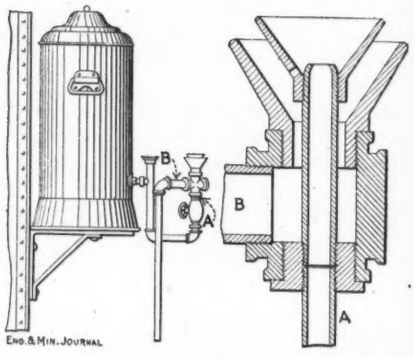
hearth jacket to the top of the furnace. The hopper is supported by an annular ring, the construction being such that the leakage of gas around the furnace top is rendered impossible. The furnace is equipped with 10 tuyeres and two cinder notches.

The brickwork of the stock line is protected by Cook high-carbon steel plates. The downcomer is connected to the furnace top by four branches equally spaced around the furnace, each connection being provided with a vertical pipe extending 22 ft. above the furnace platform and is equipped with a Roberts relief valve. In the event of a slip these valves permit the escape of gas, but prevent the discharge of ore, coke, etc. The furnace charging apparatus is of the Roberts skip hoist design connecting below with the stock transfer system, which supplies all the furnaces.

This stack has now been in operation about two months, with results entirely satisfactory.

A Sanitary Water Cooler

In recent issues of the JOURNAL, several types of sanitary water coolers for use in mines have been described. All of these depended upon there being a supply of potable water under pressure in the mine; they could not be used where such water was not piped. A form of sanitary water cooler, as described by C. A. Harrington in the *American Machinist*, is shown in the accompanying illustration. It consists of an ordinary water cooler to which a bubbling device or sanitary cup is attached. As will be apparent from the illustration, the water



WATER COOLER WITH BUBBLING CUP

from the cooler enters at *A* and bubbles up through the center cone. The waste water is collected in the outer cone and is conducted through the pipe *B* to a drain bucket situated in any convenient place. The height of the bubble may be easily governed by the distance from *A* to the surface of the water in the cooler, the height of three feet giving good results. Such a cooler can be used anywhere in a mine where it is convenient to support it upon a bracket. It can also be installed conveniently in mills or in other buildings on the surface.

Stirring Solutions by Solenoids

The objection to stirring solutions by solenoids in electrolytic analysis is that the beaker is down inside the solenoid and cannot be seen, and that the solution becomes overheated, due to lack of radiation. Knote and Work, at the Pittsburgh Testing Laboratory, put an iron core in the solenoid, and set the beaker on top of this core (*Journ. Ind. and Eng. Chem.*, July, 1912). While most of the work done by the solenoid is at the bottom of the beaker, owing to free circulation, the entire solution will be found sufficiently stirred.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Labor for Hauling and Hoisting Ore

The Arizona Copper Co's. No. 6 shaft, as stated in its annual report for year ended Sept. 30, 1911, is 460 ft. deep and has three compartments; two, 6x5 ft. in the clear, in each of which a skip of 5 tons capacity works in balance; and one manway 4x5 ft. in the clear. The gallows frame is 90 ft. high and a Humboldt hoisting engine was being used until electric power should be available.

The skips in the shaft are filled by means of a steel loading hopper, holding exactly one skip load. This is operated by one man, who, while the skip is being hoisted, draws the ore from the chute into the measuring hopper ready to be dumped into the next skip the moment it is lowered to him. The operation of loading the skip from the time of stop to time of start, does not occupy more than five seconds.

At the top the skips automatically dump into the crusher bins. The rate of hoisting with this equipment is 300 tons per hour, which indicates that one skip is loaded, hoisted, and dumped per minute. The only labor required for this operation is one hoisting engineer and one skip tender. A new haulage system was installed and connected with the shaft. It consists of a train of 20 cars which dump their load into the chutes, with but two movements of the train, in from three to four minutes. Two brakemen perform this operation.

Cinderella Gold Mines

The annual report for 1911, of the Cinderella Consolidated Gold Mines, Transvaal, South Africa, states that the company mined 222,487 tons of ore, from which 30,196 tons of waste were sorted, or about 13.6% of the tonnage mined. The mill crushed 192,341 tons of ore with an average of 70 stamps and three tube mills in 331 days, equal to a stamp duty of 8.29 tons per stamp per 24 hours. Of the ore milled 126,253 tons were treated as sand and 65,768 tons of slime were treated in the cyanide department; the gold recovered by the latter treatment was equivalent to 41.57% of the total recovered from all sources. The total cost of production was $5.81 per ton, of which $3.37 was for mining; 12c. for sorting, crushing and transportation; 48c. for milling; 48c. for cyaniding; 54c. for general mine expenses; 49c. for mine development and 34c. for head-office expenditures. The net recovery of gold equaled $6.69 per ton, leaving a profit of 88c. after deducting working expenses. An average of 686 men was employed underground, which indicates an average of about 324 tons per year per man employed underground.

Notes on New Zealand Mining

The Waihi Gold Mining Co., Ltd., Waihi, New Zealand, as shown by the official report for 1911, mined 381,873 tons of ore at a cost of approximately $1.90 per ton for stoping, general mining expenses and development. Based upon 350,699 dry tons of ore milled the total expenditures of all kinds equaled about $4.45 per ton and gross receipts from gold and silver averaged approximately $9.50 per ton milled.

At the Waihi mill, 90 stamps and 5 tube mills, an average of 72.736 stamps was operated 297 days and crushed 5.139 dry metric tons per stamp per day; an average of 3.864 tube mills was operated. The proportion of ore treated was 34.17% sand, 63.85% slime, and 1.98% concentrate. An extraction of 91.5% was made on the gold contents and 78.1% of the silver contents or a total extraction of 89.3% of the total metal contents.

An experiment was made during the year to determine what advantage, if any, could be derived by the use of cocoanut matting in place of corrugated iron in the vacuum filters. The results, taken over a period of several weeks, showed absolutely the same tonnage efficiency and completeness of wash with either the matting or corrugated iron; the matting filter has the disadvantage that it is liable to become choked with slime over a greater or lesser area if the filter cloth is torn, and it is liable to become choked with lime deposit, necessitating cleaning with acid or sand blast. It was decided to continue the use of corrugated iron as it was free from these disadvantages. Another test at this mill was made to decide the economy in using "ton cap" battery screens. The report states that an eight weeks' test showed that while the life of the "ton cap" screen was greater than that of the standard 10-mesh screen, the cost was so much greater it was decided to continue the use of the standard screen.

The Victoria mill, 200 stamps and 11 tube mills, ran 297 days and crushed 4.943 dry metric tons per stamp per day with 10-mesh screens on mortars; an average of 8.209 tube mills was in operation. Of the total ore treated, 18.63% was sand, 80.09% slime and 1.28% concentrate. The total extraction of gold and silver contents amounted to 89.2%, 91.6% of the gold and 74.8% of the silver. Referring to experiments at the Victoria mill the report states that experiments have proved conclusively that prolonged agitation is necessary on comparatively high silver assays, a profitable amount of silver being dissolved up to seven days. It is unprofitable to allow the agitation time to fall below four to five days on the regular ores.

At the Union mill, 40 stamps and one tube mill, the run was for 26 days and the extraction 89.1% of gold and silver contents, or 91.4% of the gold and 73% of the silver. The average number of stamps running at all the mills was 236.85; tube mills on ore, 12.16 and on concentrates 1.66. The tube mills make 26 revolutions per minute. The average stamp duty at all mills was 4.985 dry metric tons per day; stamps are about 1000 lb. weight; the standard screen used is 10-mesh (aperture 1.78 mm.); the residue shows about 4% of the sand + 120 mesh the value of which is too low for treatment.

All concentrates produced at the mills were treated at the concentrate-treatment plant at the Victoria mill, and equaled 1.53% of the total ore crushed. The average grade was about $105 per ton and the extraction of gold and silver in concentrate was 95% in 1911, compared with 94.9% in 1910. In 1911, 95.1% of the gold and 94.6% of the silver was recovered against 95.4% and 92.9% respectively in 1910. The cost was approximately $6.10 per ton of concentrate treated or 5.22c. per ton of ore milled.

In the cleanup and melting department 145,568 lb. of zinc-gold slime were treated in three producer gas-fired crucible furnaces (No. 200 crucible) at a cost of 8c. per furnace hour. The amalgam retorts were also fired with producer gas at a cost of 4c. per hour. The total number of assays including bullion, mine and mill samples amounted to 17,475 or approximately one assay for every 20 tons of ore treated. Stamp dies were made at the works out of old scrap steel, and while not equal to the imported dies, resulted in a 44% saving.

Some interesting data are given on the life of machinery in the water-power plant. A 200-b.hp. vortex turbine, through which an enormous amount of tailing has passed, was in excellent condition after 12 years continuous service, the only wear noticeable being in the packing boxes and glands and a little slackness in a few of the motor vanes. No. 1 turbine, 200 hp. running for about 15 years., was in about the same condition and No. 3, 100 hp. running for 11 years, did not require anything in the way of repairs. After 15 years' service a locomotive boiler was taken out for repairs on account of corrosion inside the shell. A 24-in. conveyor belt, elevating the product at Waihi mill from a No. 5 Gates crusher to a height of 40 ft., has been in use for 25 months and it is estimated that it will last another 12 months. Up to the present it has handled 252,000 tons of wet quartz.

The company is constructing a hydro-electrical works at the Hora Hora rapids. In removing a boulder bed consisting of gravel and boulders cemented together with clay and iron oxide, it was found impossible to work it by sluicing or with excavators. It was therefore worked with picks; large boulders were drilled and blasted and the spoil removed with 2-cu.yd. horse trucks. The cost for breaking, loading, and tipping the material at Hora Hora was as follows: Sand, 2c. per cu.yd.; boulder bed, 36c., and rock 24c. per cu.yd. In making foundations 9600 cu.yd. of concrete material put through the mixer represented 6400 cu.yd. in place, a shrinkage of about one-third. Where a watertight concrete was required the mixture was: 1 cement, 2 sand, and 4 stone, by weight, or approximately 5 of sand and stone to 1 of cement by measure. Where watertightness was not required the mixture was 1-3-6, or about 7 of sand and stone to 1 of cement by measure.

Labor Data, Alaska-Treadwell

During the year ended May 31, 1911, an average of 740 men were employed per day at the Alaska-Treadwell Gold Mining Co., Douglas Island, Alaska, according to the annual report. The average wage paid was $3.39 and the various rates of wages were as follows: Machine drillers, $3.50 per day; machine-drill helpers, $3.25; mine laborers, $3; amalgamators, $120 per month; feeders, $100 per month; vannermen $95 to $130 per month; machinists and helpers in machine shops, $3 to $7 per day; blacksmiths, $5 to $6; tool sharpeners, $4.50 and blacksmith helpers, $3 per day.

The total tonnage treated during the year amounted to 770,084 tons which indicated that approximately 1040 tons per man per year were mined and treated. The report states that there were 19 accidents, comprising 11 fatal, 6 slight and 2 serious accidents. Falling of rock was the common cause, six having been killed in this manner and three slightly injured or 54.5% of the killed and 50% of the slight accidents or 47.4% of all the accidents were caused by falling rock.

Cost of Producing Lake Superior Copper

The Lake Superior copper mines are credited with producing over one billion pounds of copper during the five years, 1906-1910. The production by years is given in the accompanying table.

PRODUCTION OF COPPER FROM LAKE SUPERIOR MINES

	Lb.
1906	229,632,608
1907	216,116,747
1908	222,674,918
1909	231,870,496
1910	221,826,255
Total	1,122,121,024

Almost 98% of this copper was produced by companies issuing reports of expenditures or by companies whose costs it has been possible to obtain from published data. The table given herewith accounts for 1,097,032,151 lb. of copper produced at a total cost of $116,972,394 or an average of 10.7c. per lb. It is probable that this cost would be raised to 11c., or a little over, if one could get all the expenditures of companies or individuals doing exploration or development work during this period. This list, however, includes many unprofitable mines and companies that were making preparations to produce on a larger scale; for this reason the cost of 10.7c. may be considered a fair average cost of producing Lake copper during the last few years.

SUMMARY OF EXPENDITURES AND PRODUCTION OF LAKE SUPERIOR COPPER MINES 1906-1910 INCLUSIVE

Company	Copper Produced, Lb.	Total Expenditures	Cost per Lb.	Yield per Ton Ore Lb.
Ahmeek	35,9:1,797	$4,786,018	13.3	20.9
Adventure	1,335,744	504,388	38.0	8 to 18
Allouez	17,355,301	2,942,996	17.0	15.6
Baltic	84,194,877	7,479,162	8.9	22.3
Calumet & Hecla	410,614,189	36,662,696	8.95	31.2
Centennial	10,979,323	2,074,002	18.9	13.1
Champion	88,460,380	8,155,488	9.25	24.2
Franklin	15,258,148	2,529 088	16.6	10.76
Isle Royale	21,902,821	3,906,542	17.8	14.6
Mass Cons	6,890,928	1,259,389	18.3	11.3
Mohawk	52,415,939	5,940,141	11.35	14.7
Michigan	5,016,193	1,071,043	21.4	14.7
Osceola	98.617,221	10,228,103	10.35	17.2
Quincy	101,620,225	11,433,086	11.3	about 16
Tamarack	58,314,188	8,862,878	15.2	20.9
Tri-Mountain	34,710,824	4,458,417	12.8	18.0
Victoria	5,270,393	1,003,439	19.0	10.9
Wolverine	48,163,660	3,675,518	7.65	26.7
Total	1,097,032,151	116,972,394	10.7	..

During 1911 the principal copper producers of Lake Superior produced copper for the following cost: Ahmeek 7.17c. per lb., Allouez 13.3c., Baltic 9.1c., Calumet & Hecla 8.52c., Centennial 12.69c., Champion 9.6c., Isle Royale 10.85c., Mass Consolidated 15.5c., Mohawk 10.4c., Osceola 9.28c., Quincy 11.45c., Tamarack 15.56c., Tri-Mountain 11.55c. and Wolverine 7.54c. per lb. It will be noted that with the exception of the Ahmeek, Allouez, and Isle Royale, none of the important producers made any material change in the cost of production, so that including 1911 figures with those shown in the table would hardly affect the general average given.

The real question to consider when figuring on the cost of copper is not what it costs all the producers but what it costs the profitable concerns. The copper produced by the non-dividend payers is only an incident in an attempt to create a profitable enterprise. Fully 16.5% of copper produced in the Lake district has been the result of such operations. Since 1849 about 30% of the mining companies operating have paid dividends, the remaining 70% either suspending operations or continued operations on the assessment plan.

The dividend payers in the last few years have produced fully 83.5% of the copper at a cost of about 9.5c. per lb., which represents the cost to produce copper in the Lake Superior district if only profitable operations are considered. Some of the larger and older companies have paid such enormous dividends that as a whole the profits of the district, based upon the money originally invested, are large and have been at least 340% on the assessments paid in by the shareholders in various companies.

Smelting and Refining Lead

The following facts were taken from the 13th United States census returns. In 1909 there were 28 establishments engaged in smelting and refining lead, all owned by corporations. In 1904 there were 32 concerns, 87.5% being owned by corporations, and producing 99.8% of the total production. In 1909, 75% of the concerns reported products amounting to $1,000,000 or over, compared with 56.2% in 1904 and their production amounted to 99.2% and 97.4% of the total. The expense of smelting and refining lead according to the figures given was: 0.9% of the whole for salaries; 3.4% for wages; 94.8% for materials; and 0.9% for miscellaneous expenses.

According to the annual report for the year ended June 30, 1911, of Gen. William H. Bixby, Chief of Engineers, U. S. A., the United States government maintains a fleet of 855 vessels for harbor and river improvement work. In this fleet there are 23 sea-going hopper dredges, 53 hydraulic pipe-line dredges, 61 bucket and dipper dredges, and 718 auxiliary dredges. Some dredging was done at a cost of 1¼c. per cu.yd.; the average cost for the year was 5.4c. per cu.yd. for hopper dredges and 7.18c. for pipe-line dredges. The cost of dredging the Ambrose Channel in New York Harbor was 6.05c. per cubic yard.

Mining Copper at Lake Superior—V

By Claude T. Rice

Mining amygdaloid ore is less expensive and complicated than the conglomerate. Ore is run out of the stopes either over the foot wall or through iron chutes, and what is left on the floor is recovered by scraping or shoveling. Round pillars are generally left about 25 ft. apart on the amygdaloid and in poor ore when possible. At the Mohawk, long, narrow pillars, called "dead-ends" are left at the ends of stopes. Stoping is done retreating, when possible.

Mining the amygdaloid ore at Lake Superior is less expensive and less complicated than the conglomerate, as the hanging wall is strong. The roof will often stand over areas 60 ft. square, with only a pilar at each corner, and the ore is tenacious enough to form good, stout pillars in stopes 16 to 20 ft. high, when the pillars have a diameter of 8 to 12 ft. The slope of the lode is such that the broken ore runs out of the stope readily except for the small percentage that clings to the floor on account of irregularities, and which forms a covering that hides the rough places and permits the ore to flow down. The slope is not so great but that the men can easily set up their machines in the open, unfilled stopes. The percentage of the ore that clings on the floor of the stope varies greatly with the different mines, being dependent mainly upon the amount of copper that makes along the foot wall and into the top of the underlying rock.

There are two methods of breaking the ore. One is to follow the hanging up with only a profitable width of ore, and afterwards come back and bench out all the ore that has formed irregular pockets below this arbitrary foot chosen for the first stope. The other way is to mine the ore clean from foot to hanging as stoping progresses. In this method the foot wall is followed. The method of cleaning the ore from foot to hanging as the stope is put up is used in the Mohawk and Wolverine mines, while in the other mines the policy of returning to get the ore along and in the foot is favored. It should be said, however, that only in the last two years or so have the costs been low enough in any of the mines, other than the Osceola workings of the Calumet & Hecla company, to permit coming back after ore in the foot wall. At the time the stoping was done, the supposition was that all the minable ore was being taken. In the Wolverine no great attempt is being made at present to find ore in the foot wall. It is possible that there is none, as the ore in the mine is must richer than in its neighbors.

Ore in the Foot Wall

While the foot-wall ore was mined in the Osceola Consolidated workings on the Osceola amygdaloid lode, in the earlier days, the Mohawk mine was one of the first that attempted to mine this foot-wall ore systematically; the Mohawk had always had to contend with low-grade ore and so was willing to try to obtain this leaner ore in the foot, leaving the intervening poorer areas untouched. It was this seeking after the foot-wall ore and the rough floor resulting from it in the stope, as much as the flattening of the dip with depth, that caused the Mohawk to adopt the method of cleaning its stopes by shoveling the ore into iron chutes.

The principal disadvantage in following the ore from foot to hanging, in stopes 16 to 18 ft. wide, is the difficulty in reaching the roof. In such stopes it is difficult to bar down loose rock from the hanging and the trimming of the back is apt to be neglected. There is also the possibility that, even though the copper in the ore can be seen more clearly on a fresh face, the pot-holes of ore can be skimmed out and followed better by coming back on them rather than by taking them as the main stope is carried up. It is a matter of personal opinion whether it is better to follow up the foot wall, taking all the ore at one time, or to cling to the hanging wall, taking a regular width of stope, such as is found to be rich enough to pay, and then to come back to clean up the ore in the floor; the solution depends largely upon conditions as they are found in the mine. If the ore in the floor of the stope is mined by going back over the foot, this benching begins at the top of the stope, so as to blast the ore ahead on the fairly smooth floor that has been carried up in the mining of the first stope. In this way less ore is left behind to be shoveled out of the stope than if the ore in the footwall was cleaned up, commencing at the bottom and working upward.

Cleaning the Stope Floors

In the Mohawk mine, the ore remaining on the floor after stoping is finished, is cleaned up by shoveling it into a line of sheet-iron chutes. These chutes are made from short lengths of sheet-iron plates, bent into a half circle on a diameter of 32 in. They are laid on top of the pile of muck and the men shovel into them from both sides, working up along them. At the bottom the troughs are carried on saw horses so that a car can be placed under them, and the ore is run directly into a car on the level without further handling. After the ore on the sides of the chute has been cleaned up, the chute is moved over to the clean place between the pile of muck on which the troughs were resting and the part of the stope not yet reached, and shoveling commences again. In this way the floor is cleaned with one handling of the ore and independent of the distance between levels, for when the ore is once in one of these chutes, it makes little difference whether it is shot down 30 ft. or 150 ft. to the car on the level.

In the other mines, the ore remaining on the floor of the stope is either scraped and shoveled down to the level, or, when much ore is to be handled, a rigging is installed whereby with a small air hoist, a scraper of special design can be hauled up and down the stope to work the ore down to the level. If the bottom is not too jagged, such a scraper works well and a stope can be cleaned with it much more cheaply than by hand, but even with it working at its best the ore in the roughest places must be shoveled out on a smoother part of the floor, after which it must be taken to the level by the scraper. In the conglomerate mines this cleaning down of the stope is done by the timbermen while in the amygdaloid mines the stemmers and underground laborers do the work. In cleaning up the stopes at the Mohawk mine, six men, four shoveling and two tramming, will get out 42 tons. This makes the cost for shoveling 18c., and tramming 10c., a total of 28c. per ton of rock cleaned from the floor.

Stope Pillars

The distance between pillars in the stopes depends largely upon the amount of fissuring that the hanging wall has undergone. Most of the small cracks are filled with calcite, but considerable laumonite also occurs in them. The latter has no binding power and crumbles almost immediately upon contact with the air. The size of the pillars also depends upon the number of seams and cracks passing through them; if they are broken up to any extent they dribble away rapidly under pressure. The pillars, of course, are cut out at right angles to the walls and it is advisable to permit them to belly out slightly at the top and bottom, as that has a tendency to cause them to stand better under weight and decreases the tendency to dribble away. In some of the mines the distance between the

pillars is not more than 25 ft., but probably an average would be about 40 ft. apart on the strike and about the same, or somewhat less, on the dip.

The second line of pillars in the stope is generally, but not always, staggered with respect to those below. In leaving these pillars, as poor ground as possible is selected and those places are chosen where the width of the lode is small, because less copper is left in the mines in that way and also a stronger pillar results. The upper sides of these pillars are generally shaped to shed the ore as much as possible. Probably about 6 or 7% of the ore is left as pillars in a stope. It is planned by some operators to save much of the ore in these pillars, but that is only a hope, as up to date not a single pillar has been robbed in one of these amygdaloid mines, although a number of stopes in the Mohawk, Allouez and other mines on the Kearsarge lode have already caved and practically all the upper-level stopes in the Osceola Consolidated workings on the Osceola lode, have been closed for several years.

Pillars Cut in Lower-Grade Ore

The general method of mining the ore is to put up a raise-stope as far out from the shaft as possible and to begin stoping from that, generally slicing across the top of the stope, parallel to the level, leaving as many pillars as it is judged necessary to hold up the back, but always providing ample support to the hanging. It takes three holes to break the ore from foot to hanging in one of these stopes, regardless of the width, whether 9 or 12 ft. These holes are all drilled to carry water, and a column 8 to 10 ft. long is used. In lifting the machine and arm up on this post for drilling the top hole, a chain and drill are generally used. The men work on a stage of 2-in. planks, carried on a drill or a piece of 1½- or 2-in. gas pipe that rests at one end either on the foot wall or in a niche in the face, and at the other end is tied by a chain either to a piece of gas pipe or a long drill that rests against some shoulder of rock in the hanging wall. With the chain, the height of the cross-piece can be changed quickly so as to vary the height of the stage as desired. It is surprising how firm a stage can be made in this manner.

To the Western miner, a peculiarity of the set-up is the small amount of top blocking used, generally only a wedge. A large top blocking is not necessary in order to get a firm set-up, as the ground is firm instead of somewhat yielding, as are many of the Western stopes; a 2-screw jack is used instead of a one screw post, as in the West, where seldom is a bar over 6 or 6½ ft. long, necessary. The post part of the bar is a 4-in. gas pipe. This size, with a 2-screw jack, gives a fairly firm bar with a 10-ft. post, but with a 12-ft. post it is somewhat wabbly. However, such a long post is occasionally necessary.

Drilling With Long Posts

An accompanying halftone shows a machine set up in a stope at the Tamarack mine. The number of wedges used in the top header of the post is somewhat more than usual because of the irregularity of the roof at that particular point, but the picture shows to good advantage some of the difficulties of the drilling when such a long post must be used. It is because of the small amount of blocking that is generally used in the set-up and because of the fact that the bottom blocking is generally placed on the solid rock of the floor of the stope, that it is possible to drill with such long posts. The bar used is one of the old fashioned Rand, two-piece type, but this is not used as much now in the mines of the section under discussion, although it is still used almost exclusively in the Copper Range mines. Instead, the Osceola type of two-piece bar, which has already been described in the JOURNAL, is rapidly replacing other types. In the conglomerate mines, owing to the proximity of timbers to the face, the men stage up on planks or poles braced at their far ends against the battery timbers, as it is easier and better than the gas-pipe staging used in the amygdaloid stopes, where there are no timbers to aid in the carrying of the drilling stage.

Because of the long distances that the miners must go to get protection from the blasts, the Calumet system of firing blasts with a candle snuff, arranged to burn through the fuse and set fire to the powder train, is demanded of the men in the Calumet & Hecla mines, but in the other mines the men take their chances and generally spit the holes. In most of the mines 45% ammonia dynamite is used and a 5-X cap, but in some only 40% dynamite is employed. The powder cap and fuse are issued to the taker on each contract and they are stored under lock and key in individual sheet-iron magazines near the stope that the miner has a contract on. The dynamite is in one mazagine while the cap and fuse are in another, supposedly about 30 ft distant.

Handling the Ore in the Stopes

The stopes in the amygdaloid mines are generally from 100 to 200 ft. long with an average between 120 and 150 ft. But the length of the stope is unimportant in its mining as there is not the necessity for finishing a stope within a certain length of time, that exists in the heavy ground of the conglomerate workings, and the length is determined largely by the ore occurrence. Generally it is arranged so that a stope will be worked through from level to level in from six to eight months with one drill running on each shift.

A Set-up in a Tamarack Stope

The ore runs down the stope fairly well and at the bottom rolls on a plank sollar or a portion of one, for in some of the mines only a plank or two is placed between the foot and the footwall rail of the track, as there is a large breakage of timber owing to boulders that come out of the stopes. Hardwood, generally maple, is used for sollar planks. In some of the mines the plan has been tried of putting in stulls and lacing them up, so that the ore piles up and can be drawn off into cars without shoveling, but the upkeep of these and the first cost makes their use more expensive, it seems, than to shovel the ore from a

sollar into the cars. In other mines a raised sollar was put in at about the height of the top of the car, so that the ore was almost scraped into the cars, but such a sollar was also too expensive to maintain. In one of the mines the plan is being tried now, of carrying a series of triangular pillars over the level with chute mouths in between, so that ore can either be drawn or pushed out of them into the cars. It is doubtful, however, whether owing to narrowness of the lodes, the saving per ton in the cost of handling the ore from them will be sufficient to pay for the cost of cutting and maintaining them, although they have the advantage of permitting stoping to be concentrated on fewer levels.

Stoping in the North Kearsarge and Allouez Mines

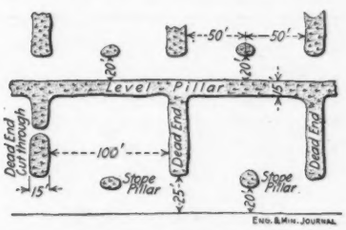
In the North Kearsarge mine the stopes are enlarged by vertical slicing along the side of the stope. In that mine the level interval is 125 ft. This stoping is arranged, as to width, so that a stope will be finished in a month. The stopes, therefore, are carried up 20 ft. wide and half the level interval, or 62 ft. high from the rails of the track on the level below, when finished. A pillar is left at the top of the drift-stope and also one at the bottom of the second stope in about every other of these stopes, but the distance between pillars in the direction of the strike depends upon the condition of the hanging wall in that part of the mine. Generally several of the first stopes are mined before the upper or second stopes are taken. These second stopes are also sliced up from below parallel to the shaft, and if stoping is finished in that part of the ground on the level above, the level pillar is cut out. Generally a level pillar from 8 to 10 ft. thick is left to be cut out later. In the Allouez, as the levels are 125 ft. apart, the ground between them is worked out in three series of stopes, each 40 ft. high. At the bottom of each stope a pillar is left, while along the strike they are kept as far apart as possible. But because the hanging wall is much broken up, the pillars are left quite close together along the strike; often within 25 ft. of one another.

Osceola Workings of the Calumet & Hecla Company

In the Osceola workings of the Calumet & Hecla company, the stopes are carried from 100 to 200 ft. long, according to the ground, and about 32 ft. high with the breast running more angling with the strike than in the other mines. When the lower stope has been carried through to its length by this diagonal slicing, drilling begins in the block of the stope directly above, and this block is also worked out by diagonal slicing. Because of the poor hanging in the Osceola lode, pillars about 8 ft. in diameter are left about every 30 ft. along the strike, but of course this varies with the condition of the hanging wall. It is in the Osceola workings that the most copper is obtained from the floor of the stopes, for while the regular streak of ore along the hanging has generally an average width of only about 9 ft., ore will often make off into the floor for a distance of 15 ft. or more. It is frequently the practice, in the wider stopes, to follow the ore in on the level so as to protect the trammers, while they are loading their cars, from any boulders that may come from the roof where the ore is being benched down.

Stoping in the Mohawk Mine

In the Mohawk mine stoping is done on an entirely different plan. The stopes there are 100 ft. long and the level interval is also 100 ft. In the center of each stope and even with the top of the drift stope, as can be seen in an accompanying sketch, a pillar is left having a diameter of about 13 ft., as the width of the lode in this mine, which averages



Method of Leaving Pillars at the Mohawk Mine

about 20 ft., necessitates leaving larger pillars than in the narrower stopes in the other mines. Along each end of the stope a pillar about 15 ft. wide is left, called locally a "dead-end", extending from the top of the drift-stope, or possibly commencing a few feet above where the back of the drift-stope came, to the pillar that supports the level above. This requires that a sort of raise-stope shall be carried up at one end of the stope, from which slicing begins each time that the stope is carried up with a breast parallel to the strike, as is characteristic with the slicing in the other mines. The foot wall is followed and, because of the width of the ore, a brow is carried at the top of the stope, under which the machine can be set up as the slice is carried across. With a dry hole looking down the stope the brow of the previous slice is blasted down and the ore is stripped clean from the hanging wall.

The drawback to this method of carrying the pillars for supporting the roof, is that it requires the stoping to be done with poor ventilation prevailing after the stopes have been carried up halfway to the level above; also, in taking each slice across the roof, a cut must be worked in before efficient slicing can begin. It would seem also that the roof could be better supported with the same amount of ground left in the stope, were it distributed in several pllars, as is the practice at the other mines. By concentrating the support to the hanging wall in a few pillars, and leaving those larger, there is less dribbling away of the ore in them, but the placing of the pillars in such an aroitrary manner along the strike prevents the selection of the ground that is left to form the pillars and, good or bad, the ore must go into the "dead-end" when it happens to be where one of these must be left. It seems likely, therefore, that this arrangement of pillars, although now quite characteristic of stoping at the Mohawk, will be abandoned in time, for already these "dead-ends" are occasionally cut through and the continuity broken.

MOHAWK AND WOLVERINE COSTS

	Mohawk	Wolverine
Milling per ton of ore stamped	$0.207	$0.253
Transportation, per ton of ore stamped*	0.120	0.143
Beneficiating one ton of ore	1.43	1.64
Total cost per ton of ore and waste hoisted	1.27	1.59
Tons hoisted, 1910	906,423	400,296
Tons stamped, 1910	802,537	388,476
Tons sorted	103,886	11,820
Percentage sorted	11.46	2.95

*For Mohawk, 15 miles; Wolverine, 18 miles.

AVERAGE COST OF STOPING AT THE MOHAWK MINE IN 1909 AND 1910

	Per Ton of Ore Broken	Per cubic Fathom Mined
Labor		
Machine men	23.8c.	$4.01
Drill boys	1.2c.	
Shoveling*	14.0c.	2.52
Supplies†	7.8c.	1.26
Totals	46.8c.	$7.79

*16.6 tons per man per $2.30 shift.
†Dynamite, 40%, costs 12c. per lb., delivered underground.

Stoping by Retreating

In all this stoping the work commences as near the boundary as possible. It should, of course, always begin at the boundary and does at all the Calumet & Hecla company's mines, but at almost all the other mines in the district, except the Ahmeek, it is necessary to start stoping before the drift-stope has reached the boundary. At the Allouez, where the ground between levels is being mined in three stopes, the company hopes to be able to get the drifts to the boundaries before it becomes necessary to mine more than the first series of stopes. In other mines a stope is put up from

level to level as far out from the shaft as possible and when that is finished the miners jump out as far as they can towards the boundary before they commence stoping again. The greatest troubles that come from this practice of stoping before the boundaries are reached, are that the blasting greatly injures the tracks so that tramming from the stopes that are put up later nearer the boundary, is interfered with, while the mucking in the stopes hampers considerably the tramming from the drift-stope within.

Further, a stope occasionally caves and ties in the ground so that the ore has to be slid down to a level below to be taken to the shaft; neither is it as safe for the trammers, because slabs are likely to fall from the roof of the former drift-stope, and boulders may drop from the roofs of the stopes and roll down and catch the trammers as they pass. Again, if the rock that falls is not large, small pieces may roll down on the track and throw off a loaded car, causing delay. These disadvantages may seem small and trivial but they are the things that count when it is attempted to pay dividends on ore that yields only 14 or 15 lb. of copper per ton of ore, with low prices for copper. It must be remembered also that anything that interferes with tramming in these mines is of much greater importance than at Western mines where skip chutes or stations are used; anything that holds up tramming on one level not only delays hoisting but even affects tramming to some extent on other levels, as the cars may be filled before the skip reaches those levels.

It is not the breaking of the ore so much as it is the getting of the ore out of the mine that is the problem at these amygdaloid mines with a low dip.

In the stopes the machines broke 45.6 tons per two-shift day and the machine men earned $2.72 per shift. The total cost per ton of ore stamped at the Mohawk mine in 1910 was $1.433 when 802,537 tons were crushed at the mill, while the total cost per ton of ore hoisted was $1.27 as 108,886 tons out of 906,423 tons were sorted out at surface. The average number of tons obtained per man underground was 4.15 and there was 0.61 lb. of 40% dynamite used per ton of total ore broken.

(To be continued)

MINING COSTS AT MOHAWK AND WOLVERINE MINES

	Mohawk		Wolverine	
	Per Ton of Rock Hoisted	Per Ton of Rock Stamped	Per Ton of Rock Hoisted	Per Ton of Rock Stamped
Supplies, breaking ground	$0.089	$0.100	$0.117	$0.121
Labor, drilling	0.298	0.337	0.316	0.326
Underground superintendence	0.014	0.016	0.008	0.008
Timbering labor	0.010	0.012	0.021	0.022
Tramming labor	0.162	0.183	0.175	0.180
All company account labor*	0.094	0.106	0.090	0.093
Carpenters, blacksmiths, masons, machinists and teaming	0.022	0.025	0.034	0.035
Hoisting and pumping	0.032	0.036	0.058	0.060
Air compressors and drill maintenance	0.072	0.081	0.088	0.091
Supplies and electric light	0.040	0.045	0.005	0.006
Rock house	0.064	0.071	0.052	0.053
Miscellaneous surface expense, with rents credited	0.017	0.019	0.028	0.029
Office and incidentals, assaying, surveying, marketing, mineral tax and insurance	0.056	0.064	0.152	0.160

*Cleaning stopes, 55 per cent.

Tests of Refractory Material

The U. S. Bureau of Standards has been investigating clay refractories, and has made the following suggestions (*Technologic Paper No.* 7, Bureau of Standards). The No. 1 clay refractories are divided into two classes, *A* and *B*. The first includes those materials for which both refractoriness and load-carrying ability is required; the second, those where refractoriness is demanded, but compressive strength is not a main requisite.

No. 1 *A*—Materials of this class should show, when heated at a rate such that the final temperature is obtained in not less than one hour, a softening temperature of not less than cone 31, approximately 1690° C. When subjected to the load test at 1350° c. and under a load of 50 lb. per sq.in., a standard firebrick tested on end should show no serious deformation and should not be compressed more than one inch, referred to the standard length of 9 in. When tested on end, at atmospheric temperature, the compressive strength should not be less than 1000 lb. per sq.in. The product in its manufacture should not be fired to a maximum temperature lower than corresponding to cone 12, or approximately 1350° C. Upon chemical analysis, the empirical calculated formula from the composition should show a total RO content of not more than 0.22 molecular equivalent, including the iron oxide as FeO.

No. 1 *B*—The average softening point of this class of products should correspond to a temperature of not less than cone 31, about 1690° C. In the load test it should show no serious deformation or a contraction of more than one inch, referred to the standard length of 9 in., at a temperature of 1350° C. and a load of 30 lb. per sq.in. When tested for compressive strength, on end, at atmospheric temperature, the crushing strength should not be less than 800 lb. per sq.in. The product should not have been fired to a maximum temperature lower than that represented by cone 10, about 1300° C. The chemical formula calculated from the analysis should show a content of RO fluxes of not more than 0.22 equivalent. One important point has been left unconsidered in these specifications, namely, the question of shrinkage or expansion upon heating firebricks to higher temperatures. It was thought that the data at hand were insufficient to suggest any requirements.

No. 2—The softening point of this class of refractories should not be lower than the temperatures corresponding to cone 28, approximately 1630° C. In the load test the materials of this classification should be able to carry a load of 25 lb. per sq.in. at 1300° C. without serious deformation or a contraction greater than one inch, referred to the standard length of 9 in. The chemical formula, as calculated from the analysis, should not show a content of more than 0.32 equivalent to fluxes.

The general conclusion is that mere tests for refractoriness are not sufficient, and that the bearing test must be added. Also, that American brick comsumers will find it advantageous to be willing to pay high prices for brick which will stand up to test, rather than low prices for what will not.

Laurium Mines, Greece

The annual report of the Laurium Mines Co. states (*Min. Journ.*, June 22, 1912) that 30,000 tons of zinc ores, 10,253 of argentiferous lead, and 63,000 of iron and manganese ores, a total of 103,316 tons, were sold, showing a diminution of 24,000 in comparison with 1910. Zinc ores maintained their output, but that of lead was 1070 tons less. The value of the silver in the lead decreased 3 oz. per ton. The fall in the production of manganiferous iron ores was due to higher freights and the disinclination of the smelters to purchase low-grade ores.

Notwithstanding, the high price of metals during 1911 has permitted the attaining a gross profit of £82,461, an excess of £17,401 over that obtained in the preceding year. The briquetting plant, started at the commencement of the year, has proved successful, and the last of the roasting furnaces will be at work in August. It is proposed to put up works for the utilization of arsenical byproducts. Toward the termination of the current year it is intended to begin the examination of the third contact deposits in the north of the concession, one of the great geological problems of Laurium. The balance, £26,080, permitted a distribution of 16s. per share.

Cyaniding Troubles and Remedies—I

By Herbert A. Megraw

Both mechanical and chemical difficulties occur in cyanidation. Variation in the size of crushed ore causes trouble in subsequent treatment. Water for preparing cyanide solution often contains cyanicides. Some salts unsuspected cyanicides. Solutions fouled by long use should be regenerated or discarded. Use of lime should be accompanied by care for several reasons. Other coagulants may be used at times.

In the regular course of operation of all metallurgical works there appear from time to time conditions which result in erratic and unsatisfactory results. The cyanide plant is no exception to this rule. Being, as it is, a process depending upon both mechanical and chemical principles, error in either of which will result in failure to secure a satisfactory ending of the operation, it may be said to be one of the most delicately balanced processes to be found in the field of metallurgy. The fact that many cyaniding installations are proving financially successful in the hands of operators who may be lacking in one or both of the departments mentioned, is no proof of error in my statement, for it may be said with certainty that any plant which is not operated under the direct supervision of skilled mechanical and chemical ability, is not delivering the maximum satisfaction which might be obtained under such skilled direction.

Trouble both Mechanical and Chemical

The troubles and difficulties which may occur in the operation of cyanide plants are legion, and he would be bold indeed who essayed to name them all. However, experience in the operation of many plants of the kind has shown that certain of these difficulties are most common and it will be my object, in this paper, to call attention to these and to suggest, where possible, the remedy best suited to the occasion. As both chemical and mechanical difficulties occur, both will be mentioned, as they are of equal importance.

Crushing and Grinding

A great many of the difficulties in cyanidation originate in the department of crushing and grinding, but this department is usually given scant attention and the trouble is almost always ascribed to some other cause. The original treatment scheme for an ore is invaribly based on some definite degree of fineness, and it ought to be perfectly clear that a variation of this degree of fineness will result in a variation of the effect of the operations which follow. If, for instance, in the leaching of sand, the economical maximum was designed to be attained by the treatment of a product, all of which will pass an 80-mesh screen, then means should be adopted to be certain that all the product will reach that degree of subdivision. If a portion remains on a 60-mesh screen, the same results can not and should not be expected. It is equally true that if, in a plant designed for all-slime treatment, with say 85% through a 200-mesh screen, then the regular daily product should be known to conform to that requirement or the results will not be those expected. It is not at all unusual for some variation of the grinding to occur, and the cyanide man, if his experience has not led him to realize the chance for trouble in this department, will be most likely to look for it in the cyanide plant proper and will be accordingly surprised when he fails to find the cause of the trouble.

The causes from which variations in crushing and grinding may arise are such items as the breaking and wearing of screens in the grinding machines, lack of proper attention to tube mills, bad condition of the tube mills or other grinding machinery, or overfeeding of such machines. Also it may occur that the classifying machinery is in bad condition, or that it is being overfed. All these points must receive their due share of attention if satisfactory results are to be obtained. It often occurs that mill superintendents will force grinding machines far beyond their capacities, either to induce a reduction of the cost per ton, or to make up for time lost in repairing, or for other similar reasons. This procedure is only justifiable after it has been clearly shown that the ultimate profit is greater than that obtained by following out the original scheme of treatment. A reduction of the recovery per ton is certain, and a more than proportional reduction of working costs must be definitely shown. Even if this is sure, it is an open question whether or not a waste of the resources of a mine in this way can be justified, and such questions should be decided by persons upon whom entire responsibility can be placed, and should never be undertaken by the mill man.

Crush in Water or Solution?

Crushing and grinding are performed either in water or in solution. Crushing in water is the older method, and was followed for years before metallurgists convinced themselves that no exorbitant loss of cyanide was incurred by performing the crushing and grinding operation in solution of low cyanide content. There are still some conditions under which it is better practice to crush in water, as difficulties are avoided by so doing, and afterward to separate the water as closely as possible in order to avoid unduly diluting the treatment solutions which are subsequently used. Such cases are usually those where the ore contains cyanides in such quantity that any cyanide contained in a crushing solution would be totally destroyed. When such cyanides consist of organic matter, or reducing elements, it is good practice to crush in water which contains compounds calculated to rectify the objectionable contents of the ores. Such compounds as lime, caustic soda or potash, bleaching powder, etc., may be used with good effect.

Separate Oxidizing Circuit

I had occasion, at one time, when considering the treatment of a large accumulation of slime resulting from ancient patio treatment, to recommend the pulping of the slime in an alkaline oxidizing solution, giving appreciable time for the agitation of the pulp, and then separating the water closely and carefully by means of pulp thickeners, delivering to the cyanide plant a product containing less than 50% moisture. The objectionable content of this slime consisted of decayed organic matter, sewage, etc. and the direct pulping of the material in cyanide solution would have entailed a consumption of cyanide so great that there would have been no profit in the treatment. By pulping in solution as I have above stated, the consuming tendency of the slime was so reduced that cyanidation proceeded in a perfectly normal manner. In this particular case, the alkaline water was contained in a circuit separate from the cyanide solutions and used repeatedly until it became too foul to be of further use. The consumption of water was not exceedingly great.

Grinding in water has some disadvantages which must always be taken into account when such practice is under consideration. Where the whole product is reduced to such a point that it may be treated as slime, that is, making a total slime product, the whole reducing system of operation must be carried out in water. This is likely to introduce mechanical complications requiring extra tanks, pumps, etc., and in addition reduces greatly the time of contact of the ore and cyanide solutions. The latter is an important consideration, for it has been clearly proved that the intimate contact and agitation induced by the grinding machinery, stamps, chilean mills, etc., and particularly tube mills, results in a better extraction, in proportion to the time of contact, than in any other subsequent operations. The loss of this efficiency is an item worthy of the most serious consideration.

Preliminary Wash for Accumulated Tailing

In such cases as the treatment of accumulated sands which are to be leached in order to recover the precious metals, it is often quite necessary to give the material a wash with clear water, or water containing lime or some other agent calculated to reduce or to obviate entirely the cyanide consuming power of the tailing. Such accumulated sand tailing usually contains some cyanicides such as more or less decayed vegetable matter or elements introduced during the old processes of treatment. It is always advisable, and often essential, that the objectionable elements be altogether eliminated or else so changed chemically that their ill effect upon solutions used in subsequent treatment be lessened or avoided entirely.

A case of this kind came up in Mexico where it was proposed to re-treat by leaching an accumulation of tailing from old patio treatment. This tailing consisted largely of sand of various degrees of fineness, mixed with perhaps 15 to 20% of slime. The tailing had been thrown out for many years and was covered with a growth of vegetable matter which introduced an element of cyanide-consuming effect. In addition, the chemicals which had been used in the former treatment, such as copper sulphate and mercury, also introduced disturbing factors. It was found that a preliminary water wash, and subsequently a highly alkaline water wash removed most of the difficulties and permitted profitable treatment, although the contained metals in the tailing, largely silver, were exceedingly small. The water washes were run to waste, as it was found economical to do so. Of course these washes had little effect on the mercury or copper, which had to be handled along with the silver and gold extracted. It did, however, destroy the ill effect of the organic matter and removed an appreciable portion of the soluble copper.

In this connection an interesting case is that of the cyaniding of the dump of the Lady Gladys Co., Mulline, Western Australia, cited by H. R. Edmands.[1] According to the description this dump contained marcasite, blende, arsenical pyrite and the decomposition products of these minerals. It was exposed to the weather for three or four years and was, naturally, exceedingly acid. The average acidity was 12.2 lb. CaO and the total acidity 35.2 lb. per ton. The treatment, as described by Mr. Edmands, was as follows:

> The main features in the successful treatment consist in first adding about 50 lb. of slaked lime per ton, which had to be thoroughly mixed, and then passing the mixture through a ½-in. screen, all the slime lumps being broken up. After charging the vat with this mixture, the next step was to wash with water or barren solution. The first wash always came off slightly alkaline. The original sand contained about 3.3 lb. Fe_2SO_4 per ton, which was now converted into ferrous hydrate. It was necessary to thoroughly oxidize this to ferric state, otherwise the destruction of 8.1 lb. of KCN would result. Oxidation was accomplished by giving a succession of washes and draining between each wash. All wash water was well aerated, air being admitted into the suction of the centrifugal pump used, but the greater part of the oxygen supplied was contained in the drained sand, which was for the most part, forced downward through the charge by each succeeding wash. It was estimated that a wash of 31 tons would contain about 0.4 lb. oxygen in solution, but the drained sand would contain about 14 lb. oxygen, most of which would be forced downward through the charge. The washing occupied four to five days, about ½ ton of solution per ton sand being used. In some cases, 1 lb. of lead acetate was added to the wash water, but without marked benefit.

After describing the subsequent cyanide treatment, Mr. Edmands notes the importance of this preliminary washing as follows:

> Before the treatment described was adopted, the first charges treated threatened total failure. To these vats only 16 lb. of lime were added, the mixture was imperfect, and it was not screened. The idea was to wash out some of the soluble acidity and then complete the neutralization with caustic soda. The first wash came off showing soluble acidity equal to about 7.6 lb. Na_2O per ton of solution; this with succeeding washes was thrown away until the acidity had fallen to 1.5 lb. Na_2O. The wash was then neutralized with lime, soda added and the solution returned to the vats. A large amount of pumping was required; much time was expended, an additional 34 lb. of lime and 34 lb. of caustic soda were consumed per ton, bringing the total amount of lime up to 50 lb. and of soda to 34 lb., which was more than twice the amount called for by the "total acidity" test.

This case is a good example of the type where preliminary treatment in water is of prime importance, and gives some idea of the necessity of careful study in each case.

Another instance along the same line is the problem of treating dumps of tailing in the mining district of Santa Rosa de Osos, department of Antioquia, Columbia, explained by R. W. Perry.[2] The tailings were the accumulation of the last 70 years and were in great part derived from sulphide ores. Mr. Perry says:

> The charges first received several water washes and as a rule no cyanide was added until the solutions showed an alkaline reaction, when a weak solution from the sump was run on. The treatment of this deposit was entirely by leaching, as is usually the case when only a comparatively small quantity of the material is available for treatment.

[1] Eng. and Min. Journ., Mar. 23, 1912.

[2] Eng. and Min. Journ., Mar. 9, 1912.

Crushing in Solution General

Crushing in cyanide solution is now generally practiced. It took some time to convince metallurgists generally that cyanides were compounds of sufficient stability to resist the agitation and long exposure to air that had to be undergone in crushing operations without decomposition, but it is now quite evident that if the strength of the solution is kept within reasonable limits, there is no danger on the side of decomposition. The first mills to adopt the system held the strength of solution down to a low point, but at the present time some mills are using solutions as high as 0.18% KCN for milling without any sign of deterioration.

One of the points of special interest in crushing in cyanide solutions is the fact that all solution lines and passages must be cared for in such a manner that leaking is avoided. A great many cases of excessive cyanide consumption may be traced to leakages which have escaped notice. In one case I encountered a case of leakage that was curious. The solution storage tank was a large receptacle of concrete built with its bottom below the ground level. In building the tank every care had been taken to prepare a solid, tight foundation, and for some time there was no difficulty with it. After the plant had been running about eight months, it was found that the consumption of cyanide was increasing slowly but regularly and no chemical reason could be found for it. A close investigation brought to light the fact that the bulk of solution was also decreasing and this led to suspecting a leak somewhere. The bottom of the tank was examined carefully, and although no decided cracks or openings could be found, still it was discovered that the tank bottom had become porous and a gradually increasing quantity of solution was being lost by percolation into the ground. A thorough waterproofing of the tank bottom remedied the difficulty and avoided the loss of solution and cyanide.

Keep Classifiers Adjusted

In the realm of classification there is little that can be said of troubles. It is only necessary to call attention to the adjustment of the machinery used for the purpose, when, provided the original design of the system is efficient, there is not likely to be any serious difficulty with results. Classification machinery needs constant attention in order that any change in the quantity or quality of the pulp may be taken care of by a corresponding change in the adjustment of the classifying machine. For reasons which have already been mentioned it is not good practice to permit a change of the sizing of the material delivered from or to classifying machinery, whether it consists of cones, screens or mechanical

types, and these must be watched carefully in order to make sure that adjustment is always maintained. When this is attended to there is not likely to be any trouble in this department.

The solutions used in cyaniding are perhaps the most important single factor in the whole operation. The preparation and use of these solutions is an application of purely chemical laws, and any infringement of them will be penalized by a loss of efficiency. This fact is not generally given sufficient attention in plant operation. The control of a chemical process as delicate as the solution of gold and silver in alkaline cyanides, with all the complications which result from the presence of a great number of elements foreign to the desired result, should be always under the control of one familiar with the basic chemistry of the process and mentally equipped to meet the emergencies which are sure to arise as the result of conditions which may be temporary and extraordinary.

Examine Water for Cyanicides

As a primary step, the water which is used in cyanidation, and from which solutions are made, should be examined to be sure that there are no factors which might disturb the balance of future operations. A great many cases of undue consumption of cyanide may be traced to the use of bad water. Mine water which contains acid is of frequent occurrence and when solutions are made from such water there will result an important loss of cyanide. Water which contains sulphuric acid, the result of the oxidation of pyrite and other sulphides may be rendered fit for use in cyanidation by treatment with lime, by which means the sulphuric acid is changed into the insoluble sulphate of calcium and removed from the water by settling or filtration.

Acids are not the only undesirable elements which may exist in water designed for cyanidation. Water which carries organic compounds will destroy appreciable quantities of cyanide and care should be taken to avoid the use of such water or to correct its cyanide-consuming tendencies before putting it into the plant. Water which contains organic compounds is generally reducing in tendency and any treatment which tends toward oxidation is to be commended. This result may be reached by the use of chemicals such as bleaching powder, potassium permanganate, and others well known for the purpose, or it may be accomplished by mechanical means. A thorough oxidation by aeration is often sufficient to satisfactorily correct a water that is not thoroughly bad. The electric current may also be successfully used to correct unsuitable water.

Methods of Regeneration

Solutions which have been in use for a long time become foul and fail to render the satisfactory results which have been obtained from fresh and first class solutions. There are a good many reasons for this action, as it is readily seen that accumulations of various elements prejudical to good results, will result from the use of solutions over extended lengths of time. When it is seen that solutions are no longer efficient, it is best to dispose of them and use new solutions, or adopt some one of the methods of rejuvenating them. Perhaps the simple discarding of an old solution is the best and most satisfactory recourse, especially when the contained cyanide can be recovered by one of the methods of regeneration.

A satisfactory method of regeneration has been proposed by Mr. A. F. Crosse. In this method the zinc-potassium cyanide, resulting from the action of cyanide solutions on the zinc used in precipitation is acted upon by sodium sulphide at about 65° C. as follows:

$$K_2Zn(CN)_4 + Na_2S = ZnS + 2\,KCN + 2\,NaCN$$

The zinc sulphide is coagulated by the addition of a little lime, causing it to settle rapidly. To prevent accumulation of caustic alkali in solution, Mr. Crosse collects the ZnS and uses it to generate H_2S, which he passes through the solution after treatment with Na_2S. The two following reactions result:

$$K_2Zn(CN)_4 + Na_2S = ZnS + 2\,KCN + 2\,NaCN$$
$$HCN + KOH = KCN + H_2O$$

Mr. Crosse reported high extractions on Transvaal gold ores by the use of solutions regenerated in this way.

Acid regeneration of solutions, as described by R. P. Wheelock,[3] offers good methods for recovering cyanide from solutions partially exhausted, and this method can readily be applied so as to save considerable money in operation.

A satisfactory way to deal with foul solutions is not to make them. This end may be arrived at by using a form of electrical precipitation, partially or wholly, which tends to remove from the solution all elements combined with the cyanide and to liberate the latter. As long as there is available alkali in solution, the cyanide liberated will combine with it to form alkaline cyanides, which are ready for further use. It has been suggested, and the method is quite feasible, that the addition of one or two electrical precipitation boxes to follow the use of zinc, either as shavings or dust, will remove troublesome elements from solution, act to regenerate the cyanide which was in combination with those elements, and also tend to aerate and enliven the solutions, putting them in first class condition for further work.

[3]Min. and Sci. Press, Dec. 18, 1909.

Electrolytic regeneration presents a simple and efficient method of accomplishing good work. A good method was presented by T. H. Aldrich, Jr., but as this method was devised principally as an aid to extraction, I will refer to it under that head.

Reducers Foul Solutions

Foul solutions are a source of much trouble in cyaniding operations, a great deal of deficient extraction being traceable to their account. Any solution which has been used, wholly or in part, for any length of time, may justly be placed under suspicion, and at the first hint of trouble in extraction, it is wise policy to investigate these solutions. In order to detect the presence of reducing compounds, in which is included organic matter, a simple expedient is to acidulate a measured quantity of the solution under test, with sulphuric acid. Assured of the presence of a small quantity of free sulphuric acid, add from a burette a standard solution of potassium permanganate as long as the color disappears. As soon as a permanent pink or reddish color remains in the solution, the reducing elements have been satisfied and the amount of oxygen required to accomplish the result is readily calculated from the permanganate used. Clennell[4] suggests a better method, which although more complicated, is more accurate. This is as follows:

Acidulate the solution under test with sulphuric acid and add a slight excess of standard permanganate solution. After allowing this to stand for some time, add an excess of potassium iodide to the pink solution, until the color changes to brownish yellow. Iodine is liberated in proportion to the excess of permanganate present. This iodine is then to be determined by means of standard thiosulphate using a starch indicator. Deducting the equivalent of the iodine found, in terms of standard permanganate, from the total quantity of permanganate used in the solution originally, the quantity of permanganate equal to the reducing agents in solution is found. Clennell notes that instead of using potassium iodide and the thiosulphate, the excess of permanganate may be determined directly by means of standard oxalic acid.

Mineral sulphates in solution have been found to act as cyanicides and while the recognition of the fact is not altogether general, most operators recognize it to a certain extent. It has been brought to my notice several times that a sensible consumption of cyanide was taking place in the operation of the plants; much more than the conditions would seem to justify. After investigation of all possible sources of error, and making sure that the solutions contained sufficient protective alkali,

[4]"Chemistry of Cyanide Solutions," p. 71.

there was no other conclusion possible but that there was a loss from some cause not yet determined. In such cases I have always gradually lessened the amount of lime in use and have generally found that it makes a difference.

Lately A. F. Crosse, in a paper read before the Chemical, Metallurgical and Mining Society of South Africa, showed that the sulphates of lime, magnesium and aluminum are sources of cyanide consumption. Mr. Crosse suggests that the use of sodium carbonate might act beneficially in such cases, but does not recommend any decided or known remedy. It would be good practice to make sure that the water used contains no sulphuric acid when it goes to the cyanide plant. If an acid water is the only thing available, the correction should be made before the water is used in the plant and the calcium sulphate removed by decantation or filtration. For the treatment of acids developed in the ores during the process of beneficiation, however, the remedy is not so simple and it seems that it would be wise to experiment with the sodium carbonate, as recommended by Mr. Crosse, or with some other alkali which would avoid the formation of salts which might act as cyanicides.

In the same paper, Mr. Crosse calls attention to the fact that arsenates also act as cyanicides. Arsenic occurs often enough in ores containing gold and silver, and is usually in iron compounds. In reference to the matter Mr. Crosse says:

> I have made many experiments in order to discover a method to overcome the injurious action of arsenates on cyanide solutions, and have found out how to counteract the solution of arsenate in cyanide solution by the following method: A solution of sodium arsenate and calcium hydrate gives the following reaction:
>
> $$2\,Na_3AsO_4 + 3\,CaO + 3\,H_2O = Ca_3(AsO_4)_2 + 6\,NaOH$$
>
> The calcium arsenate is insoluble and the sodium hydrate is regenerated. I found by a series of experiments that using an excess of lime and a small quantity of sodium hydrate, all the arsenate that was possible to dissolve was taken up by the sodium hydrate, then precipitated as calcium arsenate, no arsenic being left in the solution. The cyanide of sodium was unaffected by this reaction. The method used to determine the amount of lime required was as follows: 200 grams of finely powdered ore were shaken up every now and then for seven or eight hours with 200 c.c. of 1% NaOH solution; the amount of NaOH used up was determined in the usual way, and for every pound of NaOH required per ton, 0.7 lb. of CaO is required in actual practice, but, of course, some sodium hydrate must be present in addition to act as a solvent or carrier.

In order that best results should be had and to avoid a great deal of trouble that might occur, solutions should be the subject of frequent tests, and any lowering of efficiency should be followed up immediately by its proper remedy. Thus the solutions are kept at all times at a point of maximum efficiency.

Lime the Universal Neutralizer

The use of lime in connection with cyanidation is universal. The lime is supposed to serve a double purpose generally, that is it is used primarily to protect solutions against acids present in ores or those which may be developed during treatment. The action of the lime here is perfectly clear, in that it forms with sulphuric acid, which is the acid most generally present or developed in silver or gold ores, the insoluble sulphate of calcium, thus removing the acid radical from solution. In connection with this action, attention is called to the preceding article on solutions in which the ill effect of calcium sulphate on cyanide solutions is called to light. As has been noted, this action and the remedy for it have not been thoroughly worked out so that definite information can not be given at this time, but it is well to bear the matter in mind and institute special experiments at any plant where such trouble is experienced.

The second use of lime is as a coagulant to induce the settling of slime. Many slimes will not settle satisfactorily without the use of a coagulant, and lime has been generally used for that purpose. It is, however, true that the precise action of the lime used to assist in settling has not been accurately determined. In most cyanide plants the lime is used as a matter of course, its action in any particular circumstance being assumed and not determined through experiment. It is a certain fact that many slimes settle better without any lime at all, and equally certain that some slimes will settle better in acid or neutral solution. This is one of the points which needs to be decided for every particular ore. It might be said here that, contrary to the general idea, a trace of acidity in treatment solutions will not necessarily tend toward decomposition of cyanide to any great extent and in many cases such condition of solution tends toward better settlement as well as improved extraction. I am aware that this opinion has not been voiced to any great extent, but personal experience has shown it to be a fact and its recognizance may aid in many cases in improving working results.

There are other substances than lime which are useful for coagulating purposes, but there are likely to be other reasons which make objections to their use. Some of these agents have chemical properties which make them objectionable, or it may be that the cost is the limiting feature. Some of these agents have more effect as coagulating agents than lime, the accompanying table, compiled by Julian and Smart as results of their experiments, showing that alum has about five times the settling power of lime in equal weights.

COMPARISON OF COAGULANTS

	Weight to Produce Equal Effect
Aluminum sulphate	100
Potash alum	143
Lime	654
Magnesia	748
Calcium chloride	1,095
Calcium carbonate	1,215
Calcium sulphate	2,870
Magnesium sulphate	3,460
Sodium chloride	45,900
Sodium sulphate	61,700

In my opinion this sequence varies with different ores and it is not a bad practice to make thorough experiments on settling effects along this line and determine the scale for each ore under consideration. There are conceivable circumstances where it would pay well indeed to use some other settling agent than lime.

Methods of Adding Lime Vary

When lime is to be used there are many ways of applying it and each authority seems to differ somewhat in opinion in this regard. The usual way to apply it is to put the finely ground lime directly into the solution, either in the grinding apparatus, stamps or tube mills, or into the treatment tanks, and perhaps in both places. This, of course, seems to be the most simple and direct way to counteract acidity where it exists or is developed. Other authorities recommend the careful slaking of lime gradually with a spray of warm water and finally making a solution of calcium hydrate as strong as possible. This solution is kept in a special tank and is added to the treatment circulation by allowing a small stream to trickle in through a suitable pipe at the point where it will do the most good. This is undoubtedly the best way to secure maximum efficiency from the lime, as careful slaking and solution recovers the greatest amount of CaO available in the lime used. It has the disadvantage, however, that the hydrate is used up immediately and no provision is made for taking care of acidity which might be developed later in the treatment. The only way of taking care of this item would be to provide for the introduction of other streams of alkaline solution at points where it might be necessary. It would not be satisfactory to add a large excess at the original point of introduction, for, as has been noted, a large excess of alkali is to be avoided as detrimental to treatment.

The method of adding powdered lime in the dry state to the cold treatment solution is faulty in that only a small percentage of the CaO contained is put into solution. It has the advantage, though, that the solution of the contained CaO is not rapid, but proceeds slowly, so that the acidity as developed during treatment is more or less automatically coun-

teracted by the continued entrance into solution of the lime required to counteract it. It is undoubtedly true that in this procedure an appreciable portion of the lime goes through the treatment without being dissolved at all and is discharged with the residues, therefore wasted.

Some time ago a series of experiments was made by W. J. Sharwood with the object of determining what was the best condition of the lime for general all round results. The conclusion was that the most desirable condition in which to have the lime was in particles of about 30-mesh size. Particles coarser than 20-mesh will go through the treatment without being dissolved, while the extremely fine powder of lime gives up its available alkalinity too rapidly to be of maximum efficiency.

Another significant and highly important result of Doctor Sharwood's experiments was to demonstrate that a protective lime alkali higher than 0.3 lb. per ton of solution was actually detrimental to the extraction of gold. This is also true, to a less extent, of silver. I have personally tested this statement in practice many times and it has always been demonstrated that a highly alkaline solution is detrimental to extraction.

Determination of Available Lime

The determination of the calcium oxide in lime used for cyanidation is the subject of an extensive paper relating to the study on the subject by Luther W. Bahney, read before the San Francisco meeting of the American Institute of Mining Engineers. In the paper, Mr. Bahney recommends the use of oxalic acid as the titrating solution. The oxalic acid is made up by dissolving 14.6068 grams of oxalic acid in distilled water and making the volume up to 1 liter. The weight of lime to be taken for this study may be calculated so that each cubic centimeter of oxalic acid solution would represent 1% CaO, according to the formula

Lime	Lime		Oxalic		Oxalic
56.09	: X	: :	126.048	:	1.46068

in which X = 650

Taking, therefore, 650 mg. of the lime under study and dissolving it in 50 c.c. of distilled water, the percentage of CaO determined can be read directly from the titration. Phenolphtalein is used as the indicator.

The determination by this means may be made so that the error is less than 1%, quite accurate enough for technical work of the kind. Silica, present in practically all lime, does not interfere. Magnesia, almost always present, is slightly soluble in water and will show a faint color with the indicator. Magnesia, however, is of no use in cyanide work and should not be estimated as lime, so that it is fortunate that it is easy for the operator to distinguish the point between the lime and magnesia and no special method is necessary to divide them. Iron oxide, when present in large amount, may mask the color of the indicator, but by allowing the precipitate to settle, the titration may be carried out to within 1%. The following method of determining the amount of carbonate present in an imperfectly burned lime is given by Mr. Bahney.

Grind the sample to pass 200 mesh, weigh out 650 mg. and make the titration in the usual manner. Call this result the available CaO. Ignite 650 mg. of the finely ground sample in a muffle or over a blast lamp and make second determination. Subtract the second result from the first, divide by 1.78 and the result will be the carbonate present.

The lime used for cyanidation should always be carefully examined and analyzed for it may contain organic matter or other elements prejudicial to proper work. A careful examination of the lime will often throw light on poor results that have otherwise defied detection. The use of lime as a settling agent has largely lost its point since the general adoption of the treatment by continuous agitation. In such cases the lime is used merely as a protection for the cyanide.

(To be concluded)

Malayan Tin Mining in 1911

The report of the Senior Warden of Mines for the Federated Malay States show an increase of laborers from 170,361 to 196,427 between 1910 and 1911, and an increase in mechanical horsepower of about 2000, or 10%. Of the 196,427 miners about 189,010 are Chinamen. The tin output for the year was 44,149 tons, as compared with 43,863 in 1911. There was a surprising increase in the labor employed in opencast mining, from 122,686 to 150,439 men.

Some of the lode-mine productions are of interest. The Pahang Consolidated treated 78,448 tons of ore, and produced 18,181 piculs of tin; the Raman mined 49,886 tons, and produced 4069 piculs of tin (one picul equals 133½ lb., usually).

New Jersey Mineral Production

The value of the New Jersey mineral output for 1911 is given at $37,716,411, of which 50% ($18,837,103) consists of clay and clay products. About 25% of the total ($8,828,781) is attributed to the New Jersey Zinc Co.'s mine, which produced 341,543 tons of ore, and $1,158,271 was from 359,721 long tons of iron ore, according to State Geologist Kümmel's report.

Copper Determination with Revolving Anodes

By Frank H. Probert*

The following notes and detailed drawings describe the apparatus at the Ray Central Copper Co.'s laboratory, for the rapid and accurate determination of the copper contents of ore. It represents many advantages over the stationary-anode method. A similar outfit is used by the Miami Copper Co. At Ray Central, there is one unit of four stands, using direct current at 250 volts. At Miami, there are two units of eight stands, each using current at 110 volts. The specifications call for:

Specifications for the Ray Central's Four-cell Unit

Motor, Eck Dynamo & Motor Co., Belleville, N. J.; ⅛-hp. inclosed motor for —— volt, direct current; speed, 745 r.p.m.; arranged complete with rail base for bolting to wall to run in vertical position with pulley-end down and to start without starting rheostat; pulley to be grooved for ¼-in. round leather belting and to be 1⅝-in. diameter at base of groove.

Rheostat, Ward Leonard Electric Co., Bronxville, N. Y., or H. Ward Leonard Co., Milwaukee, Wis.; 15-in. back-of-board-type rheostat for continuous duty; 2:1 taper in ampere capacity, to pass a maximum current of 6 amp. on the last step.

Ammeter, Watson Electric Instrument Co., Newark, N. J.; round pattern F for switchboard; 10-amp. direct-current combined shunt; scale, 100 divisions of ⅛ amp., each readable to 1/100 ampere.

Anode and cathode holders, M. H. Treadwell Co., 140 Cedar St., New York; four sets each of cathode and anode holders as per detailed drawings. One pair required for each stand.

Cathodes and anodes, J. Bishop & Co., Malvern, Penn.; 4 platinum anodes, 8 platinum cathodes, as per detailed drawing; 1 anode and 2 cathodes required for each stand.

Belt shall consist of narrow rawhide belt lacing.

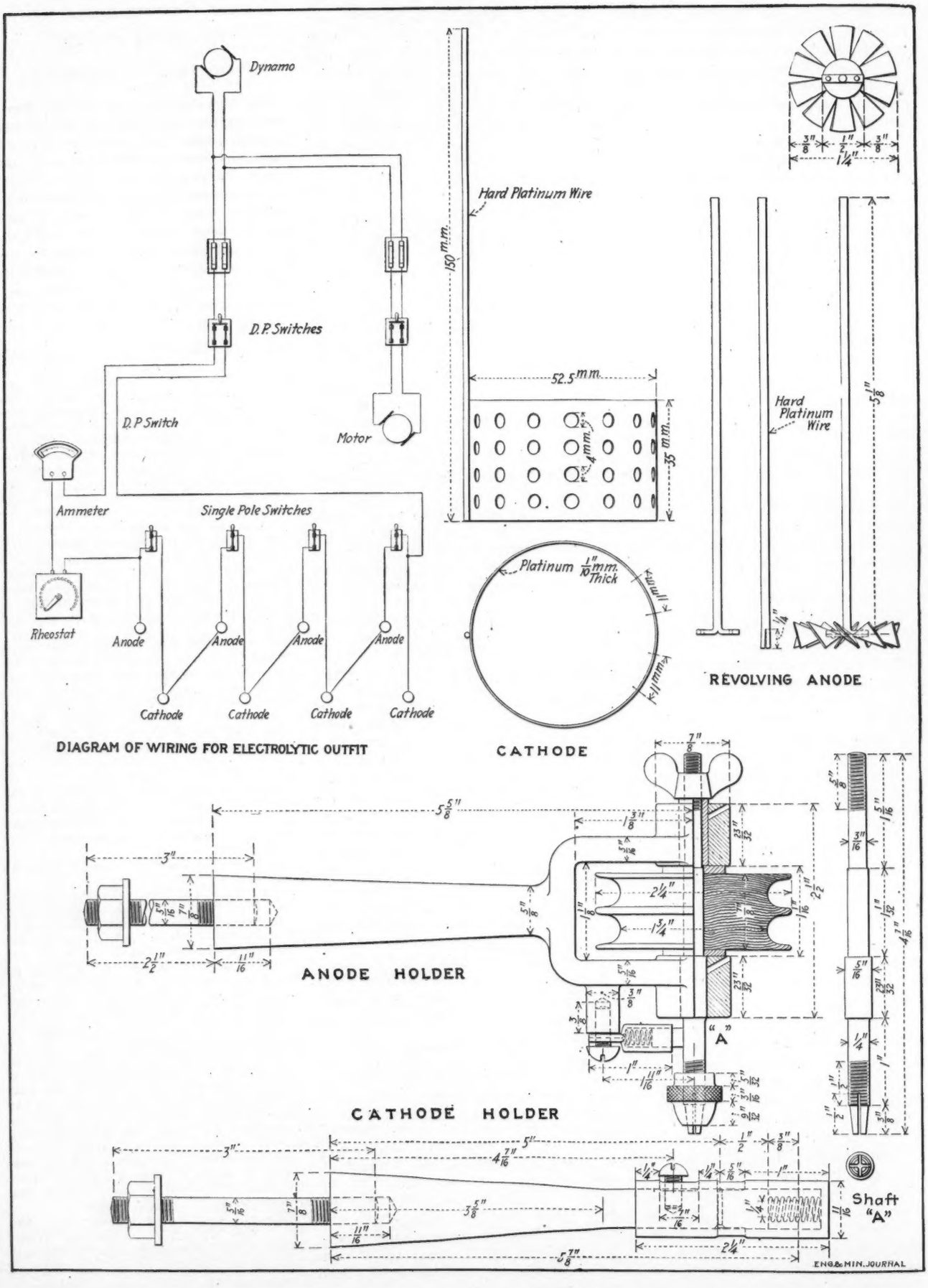
Other material (for a four-stand outfit): 4 single-pole, 10-amp. snap switches; 2 double-pole, 10-amp. snap switches; 2 straight-line, double-pole cutouts for 10-amp. cartridge fuses.

Panel, slate or wood, 1½ in. thick by 24x50 in., with shelf 1½x16x50 in. Shelf should be 40 in. above floor, and from center line of anode holders to shelf should be 12 in. Wooden blocks for beakers are 5 in. high.

Wire as shown in accompanying sketch. Before turning on current throw most of resistance in. Test to see that current is flowing from the anode to the cathode holder, before putting platinum electrodes on, otherwise part of gold solder will be dissolved from cathode and deposited on the anode. If the ammeter is wrongly connected it will show no reading, in which case, reverse the connections.

Special Supplies: 8 battery jars, 5x6 in.; 3 doz. 250-c.c. Jena beakers, Griffin form; 2 doz. casseroles, 8-oz.; 1 crystal-

*Mining engineer, Central Building, Los Angeles, Calif.



DETAILS OF ELECTRODE CONSTRUCTION FOR RAPID COPPER ANALYSIS

lizing dish, 8½ oz.; 1000 S. & S. filters, 11 cm.; 1000 S. & S. filters, 24 cm.; 1 doz. 2½-in. funnels; 1 alcohol lamp; 1 Kipp generator, 1-pt. size; 2 doz. 4-in. watch glasses; 1 good analytical balance for weighing cathodes.

Using a 1⅝-in. pulley on the motor, the time for complete precipitation is too long. We substituted a 3¼-in. pulley, which is the maximum practical size. Using this pulley, the agitation is so violent that the electrolyte is raised nearly to the rim of the beaker and there is a possibility of loss.

With the large pulley on the motor, a 2.0 gram sample containing 10% copper may be precipitated in 20 min. and one containing 2% in 12 min. For low-grade ore a current of 2½ to 3 amp. is used, which may safely be increased to 6 or 7 amp. for high-grade.

Method

Weigh out 2.0 grams of ore in an 8-oz. casserole. Add 5 c.c. concentrated HNO_3 and 3 c.c. concentrated HCl. Cover with watch glass. Digest. Add 5 c.c. concentrated H_2SO_4. Heat until dense white SO_3 fumes appear. Cool. Add 25 c.c. warm water and 2½ c.c. strong HNO_3. Heat to boiling. Filter and wash well. Add 5 c.c. ammonia (1 to 4 parts water), and dilute to about 175 c.c. in a tall beaker. Electrolyze until a drop of electrolyte gives no precipitate when tested with H_2S solution. Remove cathode, wash with water, dip in alcohol and dry quickly by ignition. Weigh. Immerse in bath of nitric acid to remove copper. Wash and dry with alcohol. Weigh. Difference in weights in grams $\times \frac{100}{2}$ gives percentage of copper.

The 4-cell unit at Ray Central has a capacity of 75 to 80 determinations per day. I am indebted to R. B. Earling, of the Ray Central Copper Co., for the detailed drawings of the apparatus.

Stand for Rapid Electrolytic Work—Ray Central Laboratory

Proposed Treatment of Rand Tailings

A proposed method of recovering at a profit the gold contained in the older dumps of the Rand, is reviewed by the Johannesburg correspondent of the *Aust. Min. Stand.*, June 6, 1912. There are several million tons of mill tailings existing at present which were made before metallurgical practice had reached its present degree of perfection. This material contains 1 dwt. and upward per ton, the great number of tons available making the subject interesting, even if the profit obtainable per ton is very small. Previous efforts to profitably recover this gold have not met with success. Concentration has been principally relied upon but has failed in every instance to produce profits.

The subject has been given much attention by Rand metallurgists and of late Messrs. Macdonald and Pollock, working in conjunction with Professor Stanley, of the South African School of Mines, have evolved a method which, after trials on an extensive scale, seems to promise success. The process involves the use of the device brought out by Professor Stanley, known as the Stanley classifier. This is described as a hydraulic classifier with a shaking screen attached to the fine overflow, with the object of preventing the loss of coarse material of low specific gravity carrying gold, such as usually escapes and is lost with the ordinary classifier. The material retained by this screen is combined with the heavy, coarse material which is separated by the classifier for regrinding.

The operation of this classifier is to divide the tailings constituting the dumps into three classes, each of which may be treated according to its requirements, or discarded if the contained metal is not sufficient to ensure a profit upon the operation. The products delivered by the classifier are, first the concentrate which is usually plus 60-mesh material together with whatever fine pyrite the tailing may carry. This is said to represent 25 to 45% of the bulk of the tailing and to carry about half the total gold. Then follows the minus 60-mesh material, and finally the slime.

On 14 tests when the content of the tailing was 1.25 dwt. gold, the average content of the concentrate was 1.80 dwt. and of the fines 0.77 dwt. gold. The separate products of this classfication were subjected to cyaniding tests and it was found that the concentrate, after thorough regrinding, gave a minimum extraction of 80% after 8-hr. treatment. The fine or minus 60-mesh material gave an extraction of 67% in 6 hr., while from the slime, 90 to 95% was recovered. It is considered that a recovery of 75% can be relied upon and the actual working costs of the treatment are estimated at approximately 50c. per ton. This estimation includes such items as transportation of the tailing to the classifier, classifying, regrinding, cyaniding, etc.—essentially operating costs, while there is usually to be added the royalty to the owner of the tailing and the overhead expenses.

Due to the small amount of profit obtainable from tailing containing approximately only 1 dwt. of gold per ton, the scale of operations will have to be large to ensure a satisfactory return. One engineer who has estimated the probabilities recommends that on this grade of material not less than 2500 tons per day should be handled. At this rate he estimates a monthly gross profit of $20,000, which figure does not allow for any royalty or administration expenses.

It is calculated that there are about 70,000,000 tons of tailing of grade sufficiently high to allow profitable treatment by this process now existing on the Rand. This tailing is the material accumulated before the introduction of tube mills, and also the accumulations up to date of those plants where tube mills have never been installed.

A company known as Sands Limited has already been formed to acquire all the rights for the classifier and is reported to have secured options to treat several million tons of tailing on the Rand and elsewhere in the Transvaal.

Benzoic Acid in Acidimetry

The use of benzoic acid as a primary standard in acidimetry is urged by G. W. Morey, of the Bureau of Standards (*Journ.* Am. Chem. Soc., Aug., 1912), because of its high molecular weight, which permits the use of large samples, its stability, its nonhygroscopic character, and the ease with which it is obtained in a high state of purity.

Inspection at Beaver Consolidated

At this mine in the Cobalt district, an inspector is employed who examines the workings twice daily, makes a report of conditions and orders such repairs and changes as he deems necessary for the safety of the men. Miners report their time, blasting records and the number of missed holes to him. Men reporting missed holes must return and fire them.

The Beaver Consolidated Mines, Ltd., Cobalt, Ont., has an excellent system of mine inspection, due to an earnest desire on the part of its president and general manager, Frank L. Culver, to protect its employees from all unnecessary dangers of mine work. Mr. Culver stated that the idea of installing a system of mine inspection originated in a conversation he had with a friend while on one of his trips to the mine. He was so impressed with the merits of mine inspection by the company itself that upon his arrival at the mine he immediately appointed an inspector. Up to that time he had thought that the mine was in a safe condition, but after receiving the reports of the inspector it was evident that there were many improvements to be made.

Inspector Orders Repairs Made

It is apparent that Mr. Culver, at the first, solved the most important question relative to mine inspection, the authority and power to be invested in the inspector. The inspector at the Beaver Consolidated mine was given the power to issue orders to any department to make any repairs or changes he deemed necessary for the safety of the men, or to discharge anyone failing to comply with the rules or regulations of the inspection department, and is responsible only to the superintendent. No matter how competent the official or how excellent the rules and work of any department, the greatest efficiency and best results cannot be obtained unless its orders are obeyed. This is particularly true with inspection work, which is apt to meet with opposition from heads of departments and other subofficials. The work at the Beaver has met with the hearty coöperation of the entire organization and all are interested in keeping the workings in a safe condition and enforcing the rules and regulations of the inspection department.

The Beaver No. 1 shaft is about 600 ft. in depth and the lowest working level 530 ft. No. 2 shaft, about 300 ft. from No. 1, is connected at a depth of 200 ft. with workings from No. 1. The property hoists approximately 35,000 tons of ore per year and employs between 130 and 140 men.

Form No. 1, a sheet 17x10 in., is a mine-inspection report filled out by the inspector twice every 24 hr. The data and names in the form are, of course, fictitious. At present two 10-hr. shifts are worked at the mine and the inspector is on duty from 5 to 9:30 a.m. and 5 to 9:30 p.m. All miners coming off shift report to him and all machine-drill men, in order to get credit for a shift's work, have to report their time and make a blasting report, stating the number of missed holes in their working. All men reporting missed holes are required to return and fire them before leaving shift. This is done in the belief that being more familiar with the face, as drilled, he is less likely to meet with an accident than the man following on the next shift, which is certainly true and such a procedure is a good safeguard against a common cause of serious accidents.

Mine Inspected Twice Daily

The mine-inspection report, as reproduced herewith, outlines the regular inspection made twice every 24 hr. Under the heading timber in shafts, winzes, raises and stopes, any repairs to timbering or new timbers to be placed immediately to insure safety are noted. Any repairs made to cables, cages, hoists, machines, etc., are noted opposite these headings. This report is signed by the inspector, mine captain, and outgoing and incoming shift bosses, which is sufficient to show that all are advised of the condition of the works and machinery.

BEAVER CONSOLIDATED MINES, LIMITED
NO PERSONAL LIABILITY

MINE INSPECTION REPORT

Day Shift (Day = Night Shift) Shift — March 9th, 1913

SHAFTS. WINZES. RAISES	
Holes Fired	17
Holes Re-fired	3
Total Holes Fired	20
Missed Holes	0
Timber	Stull 405 Winze needs bracing
Blocking	OK
Ladders	Rungs broken on ladder #2 Raise 405
Pipe Lines	OK
Signal Lines	Short circuit 300 ft. Station
Cables	OK
Cages	Cage needs 21 new floor boards
Chairs and Gates	OK
Pumps	OK
Hoists	OK
Scaling	701 Station loose rock
Machines	All in good repair
DRIFTS. X-CUTS	
Holes Fired	64
Holes Re-fired	None
Total Holes Fired	64
Missed Holes	
Machines	All in good repair
Pipe Lines	OK
Tracks	OK
Cars	#28 axle broken
Lights	OK
Tools	OK
STOPES	
Holes Fired	38
Holes Re-fired	2
Total Holes Fired	40
Missed Holes	
Machines	All in good repair
Scaling	605 #1 Stope loose rock
Pipe Lines	OK
Manways	OK
Ladders	405 Stope rung broken
Chutes	OK
Timber	OK
Sand Blasts and Blockholes	3
POWDER MAGAZINE	
Powder	240 lb. Gheddite 30 lb. Dynamite
Fuse	300 ft.
Caps	95 Detonators #8
GENERAL REMARKS	

J. Smith — Outgoing Shift Boss
H. Brown — Incoming Shift Boss
W. Jones — Captain
Jack Johnson — Inspector

SAMPLE FORM USED BY PRIVATE INSPECTORS OF THE BEAVER MINE, AT COBALT

Form No. 2 is a sheet 8½x5½ in. and is used as an order by the inspector, to either the mine captain, master mechanic, or carpenter as the case may be, to have any repairs made as indicated by the mine-inspection report. The person to whom this order is made is required to state the time when repairs were made and to sign three copies of the order; one for the mine office, one for the inspector and one for his own record. The superintendent sees that all such orders are promptly obeyed.

The men are lowered and raised on a cage, not over 10 being allowed on the cage at one time. A Stephen Humble hook to prevent overwinding has been installed at the shaft house and the cages are equipped with dogs to prevent any sudden drop. The safety devices and cables are tested regularly to insure that they are in good working order. It is the duty of the cage tender, before starting with men on the cage, to warn all to keep arms and body clear of timbers. Shafts are also provided with manways in case hoists are out of commission.

An electric-signal system for hoisting is operated direct from the electric-power

INSPECTOR'S REPORT

To Carpenter Date March 9/10

405 #2 Raise, 405 Stope

2 new rungs needed in each

ladder 2 new boards needed in cage

Time Reported 10 a m J Johnson Inspector

Time Attended to 2 P.M. 9/3/13 by J Coffin Foreman

Remarks

Will repair cage between shifts

FORM NO. 2, USED BY INSPECTORS AT BEAVER CONSOLIDATED MINES

current without the aid of batteries. The wires are lead covered to protect them from moisture and as no batteries are used there is little danger of the system getting out of commission. In case the hoisting engineer fails to understand any signal he rings a bell for signals to be repeated. All rock hoisted is brought up in cars on cages and to guard against rock falling into the shaft they are never filled to the top. The danger from mine fires is slight, owing to the small amount of timber used in the mine, other than shaft timbers, which are usually so wet that there is little danger of them getting on fire. In case of fire, shaft No. 2 could be used as an exit for the men.

The Ontario mine laws will only permit a 24-hr. supply of explosives to be stored underground, which is all that the company keeps in the mine. The underground magazine is in a drift some distance from the rest of the workings and the storage magazine on surface is situated quite a distance from the works. An emergency case is kept at the mine office for the treatment of wounds and if needed a doctor is called at once in case of accidents. Before the system of inspection was started at the Beaver there were several serious accidents, but since then only minor accidents have occurred and they have been confined mostly to the surface works.

The men at the Beaver appreciate the efforts of the company to protect them and several have stated that they had never worked in a mine where protection was as complete as at the Beaver. Mine inspection has received much attention of late and has been discussed by the JOURNAL from time to time. Mr. Culver is to be complimented on the example he is setting at the Beaver and it is certain that other mine officials will continue to take up the question of better protection for employees and thus reduce the number of accidents.

Gypsum Mines of England

LONDON CORRESPONDENCE

The gypsum mines of England are situated principally in Nottinghamshire, Leicestershire and Derbyshire in the Midlands, and in the North, Yorkshire, Westmoreland and Cumberland. Nottinghamshire is the principal producer both in new mines and quarries, as it produces fully one-half of the total of over 250,000 tons. From Chellaston about five miles south of Derby in Derbyshire, the gypsum bed follows an irregular winding southeast course, not unlike the course of a river, through Gotham, into Leicestershire, a distance of fully 30 miles and is found in the Keuper Marl. In this bed there are many million tons blocked out, and many more millions of tons have been proved by holes.

WORKINGS INDIVIDUALISTIC

Not many of the mines or quarries are worked at high pressure, although there is no combination or amalgamation as to price or output and there is but little interchange of opinion between the owners or managers of the respective works. Every one is an individual. A manager may occasionally visit an adjoining mine, but rarely visits the mill. Visitors are rarely shown through the mills, as usually there is a patent or "secret process" connected with them, therefore every mill is superior to every other mill.

There is a bed of gypsum, from four to 12 miles northeast from Appleby, the capital of Westmoreland, but only one mine is actively worked, which has a mill for grinding the rock. This mill has been at work about two years, and is quite modern, and there is a good demand for the product. The rock is hauled over an incline in side-tipping cars, and it is fed by hand into a Blake crusher. This crusher is on the ground floor, and the crushings are raised by means of a vertical belt elevator, to pass through a coffee-mill grinder, then to two sets of rolls, from the rolls to a covered screw conveyor to a second belt elevator, situated in another part of the building, to the vertical drier and mixer (made in Kansas). From the brick-encased drier three different grades are produced, which fall into the proper chutes, and discharge into 2-cwt. bags ready for the market. There is little dust. The power is suppied by a suction gas producer, and the mill is well lit by electricity.

This district has been worked for 50 years for gypsum, but the above mill is the only one at work; the other mines sell the gypsum to glass and other manufacturers, to whom it is sent by rail. One of the mines has been at work for 30 years, but only on a limited scale, prior to that it was worked as a quarry. It seems that 20 ft. is the maximum overburden which can be removed to quarry an ordinary bed. A greater depth is too expensive, as the marl or clay which overlies the bed is easily "crumbled" by heavy rains, and washes to the bottom—and covers the tracks—even if the slopes have an angle of 20°. The men cannot work during the winter six days a week, —although during February of 1911 the men worked full time in some parts of the North, which was the first time on record.

Levels have been driven in all directions to the extent of the working bed, and when the gypsum has been taken out, the roof is allowed to fall. The present working face is 120 ft. from the portal, the depth of bed 4½ ft. and the roof has to be broken to make room for the one-ton car. Here there is a "cobble roof," that is, a roof which does not let the water permeate into the gypsum; whereas with a clay roof, the rain or the water of early days carried the sand and soil in the bed and "pot holes" of varying sizes and capacities, holding from a few hundredweight to as many tons, are always found. This waste is useful to support the roofs after the gypsum has been mined.

PRACTICALLY NO TIMBER USED

In one of the mines, the overburden was 25 ft. deep, and all attempts to quarry the bed were futile. The top dirt was principally earth and fine pebbles. The bed varied from 6 to 12 ft. thick, 8 ft. were being worked in places, and a roof three feet thick supports the overburden. The mine is worked on the "pillar system," the pillars being nine feet square. The ground stands well and scarcely a stick of timber is used. A small steam pump fixed near the mouth of the tunnel working two hours a day keeps the water from the mine on ordinary occasions.

The principal mills are in the district around Nottingham. In the largest mill a special dust chamber has been built

which saves the finest dust, which commands the best price. There is a large mill also at Kegworth. Around Gotham there are three mines and mills at work, and the mines are wet. At Rushcliffe about two miles east there is scarcely any water.

A feature that surprises one is the uniformity of the bed, one of the mines had been opened on for over 1000 yd., and yet in that distance there was not a dip or rise of 12 in.; plainly showing that at the time of formation, there was a total absence of disturbances of any and every kind. This bed is about 6 ft. thick, and worked on the pillar system. In one of the mines, the roof was hard, and if it had to be taken down, explosives were necessary although unsupported for 22 yd. This bed was favored with rock faults which served as supports to the roof. The drives through these faults were just large enough to admit a one-ton car.

Labor Done by Contract

The method of working was simple; the miners are all worked on contract, 50 hours constituting a week's work, and in groups of four or six, and men paid so much a car. The contractors, in addition to taking the cars to and from the incline, filling them, and mining the gypsum, have to drive through the faults. The waste from the faults is thrown into an adjoining chamber. The mines visited were all well ventilated naturally, by a shaft or shafts sunk some distance from the opening. There are times, no doubt, when the air currents travel a little sluggishly.

In the sinking of one of the inclines to the bed, water was encountered to such an extent as to make the continuation impossible, without the use of plenty of capital; it was then decided to drive over the subterranean water course, and in the driving, test holes were sunk to the water at given distances, and as long as water was found the level was extended. Eventually the water was not found, and a second incline was sunk until the bed was found. A brick dam was built in the side of the level to prevent the water from flowing to the bed, and neither the dam or the water has given any trouble, and the workings are dry.

In another mine there was a circular brick-lined shaft, sunk 100 ft. to the bed, and equipped with cage, electrically hoisted, and cars hauled to the shaft by horses. The bed was 12 ft. thick, and the reserves amount to 3,000,000 tons. No mining has been done near the shaft. The pillars are 12 ft. square, and but little timber is necessary.

The miners use an auger bit ½ to ⅝ in. in diameter, which is easily held in position. The holes are not deep, seldom extending more than three feet, and usually a set of three drills is all that is necessary; these require to be sent to the blacksmiths but once a week, the miners sharpening the bits by means of a file. Water is not used to facilitate drilling, even in cutting-in holes.

Straws Used For Fuse

It was interesting to a miner, accustomed to fuses, both tape and electrical, and to high explosives, to see only black powder used, and the straw of grandfather's days substituted for the fuse. These miners are experts in the way that they can place the powder, whether in vertical, inclined or horizontal holes by means of a spoon scraper, then level it by means of a copper ramrod, then insert a copper pin in the hole until it reaches just below the level of the powder, next, tamp the drillings, which came from the hole, into the hole, with the ramrod, to the collar of the hole; then lightly tap the pin on the head with the handle of the ramrod, pull it out, and in its place insert the straw filled with black powder, which is now ready for the torch, match or end of a candle. It convinces one that charging holes with such material is skilled work.

In the selection of the straw, the miners select the wheaten sheaf, as the joints are larger than the barley or oaten sheaf; the bottom joints are the best. A sheaf costs practically nothing as the farmers do not make a charge as a rule, but the mine owners give the preference to these farmers to remove the ashes to improve their roads. In filling the straw with powder, one end is placed in a glass bottle filled or partially filled with powder, the other end of the straw is a joint, the bottle is turned upside down, and the reed is filled. The miners charge the holes as they are drilled, but do not fire them until the usual time. The death rate due to explosions in these mines is very low.

The gypsum is all sold, there are enough grades and varieties to suit all purchasers and as a rule, heavy stocks are not carried. The uses to which gypsum is applied are many; some of the lowest grades are used to weight the heavy brown papers.

Alabaster

There is a small quarry of gypsum worked as alabaster, near Chellaston, during the last 2½ years. This place had been tested several times during the last 300 years or more,—in all probability before the use of gunpowder, which was adopted first by the Derbyshire miners in 1575, as the marks of oblong holes can be seen, and small chips of alabaster are plentiful on the bed. In one place there were indications that the "ripper and feather" system on a limited scale was used. The overburden has been removed from a block of land about an acre in extent, the depth of soil was from four to eight feet. The surface of the bed is irregular, due, in part to the attempt of the former workers. Pot or mud holes of two feet diameter and less are plentiful and extend to the floor. The method of working is to clear among the debris from the pot holes, and to make an opening in the bed to erect a frame suitable to carry a light adjustable pulley, over which passes an endless triple steel wire. This wire passes over a fixed pulley, placed on a movable frame, adjoining a small engine. In the quarry, the pulley is weighted so that the wire when set in motion cuts into the alabaster. The cutting is assisted by sharp sand and water. This wire is not so successful or as effective as the wire and diamond saws used in the slate quarries. A length of 40 ft. is usually cut to the bottom of the bed which is less than 7 ft. Blocks of alabaster, eight tons weight, have been taken out and dressed. This alabaster takes a beautiful polish, and is used for interior church work and decorations, and is cheap compared with Italian marble.

Calumet & Hecla Holdings

The recent report of the Calumet & Hecla Mining Co. gives a list of the companies holdings, as at Dec. 31, 1911:

CALUMET & HECLA HOLDINGS

Company	Held by C.&H.	Authorized
Ahmeek	24,800	50,000
Allouez	43,000	100,000
Centennial	43,500	90,000
Cliff	19,400	60,000
Dana*	36,500	40,000
Frontenac*	20,000	20,000
Gratiot*	50,100	100,000
Isle Royale	27,500	150,000
La Salle*	152,977	302,977
Laurium*	33,500	40,000
Manitou*	18,000	20,000
Osceola	32,750	96,150
St. Louis*	35,450	40,000
Seneca*	11,207	20,000
Superior*	50,100	100,000
Tamarack	19,400	60,000
White Pine, pfd.*	3,792	3,792
White Pine, com.*	43,202	85,320

The asterisk (*) indicates stock majority is held by the Calumet & Hecla

A Galician Oil Consolidation

A merger of Galician oil companies has been arranged in London. The Premier Oil & Pipe-Line Co. is to purchase the Amalgamated Oil Pipe Lines, of Galicia, the Central Carpathian Oil Co., the Alpha Petroleum Co. and some large tracts of land owned by individual operators. The capital stock of the consolidation will be £3,750,000, divided into 1,200,000 preference and 2,500,000 ordinary shares. There seems to be a movement to merge the important Galician producers under Standard control.

Alumina in Copper Slags

In his presidential address before the Australasian Institute of Mining Engineers, H. C. Bellinger takes up the question of the rôle of alumina in the copper slags made at various smelting works (*Min. and Eng. Rev.*, June 5, 1912).

The first results instanced were obtained in smelting the ores of the Rossland district, British Columbia. Concerning these Kemp states: "The orebodies exist at or near the contact of gabbro and porphyry, the extent of the mineralized zone being about four miles long by one mile wide. The contact is not abrupt, but the gabbro passes gradually into augite, porphyrites and diabases." The gangue analyzed approximately: Al_2O_3, 14 to 18%; CaO, 10 to 12%; K_2O and Na_2O, 2½ to 3%; SiO_2, 40 to 46%. The first attempts to smelt this figured Al_2O_3 as an acid, and a great excess of lime was added. After twice freezing the furnace the charge was recalculated with alumina as a base, and the furnaces worked satisfactorily on this assumption for several years.

At Butte, however, the oxygen ratio shows a bisilicate slag even calculating alumina as a base, the slag having the composition SiO_2, 45.4%; FeO, 24.0; CaO, 18.5; Al_2O_3, 7.9%. If it be attempted to consider alumina as an acid, the ratio is 2.6:1. At Northport, Wash., the slags have the following composition: SiO_2, 43.5%; FeO, 20.0; CaO, 16.0; MgO, 4.5; Al_2O_3, 14.5%. If the alumina were considered as an acid, the ratio would be 2.8:1. At the Britannia plant, Vancouver Island, a two weeks' run gave: SiO_2, 50.4%; FeO, 20.5; CaO, 22.22; Al_2O_3, 6.5%. Were this alumina considered as acid the ratio of acid to base would be 3:1, which seems unreasonable.

At Crofton, British Columbia, Mr. Bellinger was engaged in smelting a baryta ore carrying 40 to 50% barium sulphate, and 8 to 9% zinc. Here both alumina and silica were added on account of the low formation point of the slag from the ore. At times the slags, which carried 5 to 12% of Al_2O_3, apparently contained alumina as an acid, at other times it was necessary completely to disregard it. Again, at Cobar, Australia, such a slag as: Cu, 0.3%; FeO, 51.4; SiO_2, 39.2; Al_2O_3, 6.5; CaO, 0.6, seems to contain the alumina as an acid, such an assumption giving very close to a bisilicate slag; while in the slag: Cu, 0.2%; FeO, 49.2; SiO_2, 41.4; Al_2O_3, 5.8; CaO, 1.0, if the alumina be completely ignored, the slag will be found to conform closely to the bisilicate ratio.

Attention is called to the many different forms in which alumina occurs in nature, in view of which it is scarcely surprising that alumina refuses to take any definite place in slag formation. Many engineers have found that calculating acid-soluble alumina as an acid, and insoluble alumina as basic or neutral, good results were obtained. While Peters says this has no scientific foundation, the fact remains this method of calculation often leads to success.

The Baldwin Candle Lamp

A new light for use in metal mines to replace candles is a kerosene lamp which slips into the regular miners' candlestick. The lamp weighs only four ounces when filled, and as one-eighth of a pint of oil affords fuel for 10 hr., the manufacturer claims a cent's worth of oil will supply more light for 35 hr. than a candle gives.

The lamp is strongly constructed; no parts are screwed together. The burner

THE BALDWIN CANDLE LAMP

fits into the neck with a long sleeve, which is practically tight. The long, thin neck prevents any oil from slopping over when the lamp is being carried or jabbed into a prop. A larger size is also made, weighing eight ounces when filled. This gives a three-candlepower light 17½ hr. for a cent. It is marketed as the "Baldwin Candle Lamp" by the F. E. Baldwin Manufacturing Co., 320 Broadway, New York.

Census Bureau's Report on Mines

WASHINGTON CORRESPONDENCE

The bulletin on mines and mining, in preparation by the Census Bureau, will contain a complete survey of the results of its investigations during the last two years and will present the statistics for producing mines, quarries, petroleum wells, etc. A distinction is drawn between producing and nonproducing mines and the data are given geographically. An interesting phase of the report, it is understood, will deal with the acreage of lands operated and the character of their ownership, whether by individuals or by corporations. Congress is likely to undertake some important legislation with reference to mining questions at the next session and the bulletin is expected to furnish some of the necessary data for determining certain phases of the legislation to be adopted.

Changes at Porcupine Mills

PORCUPINE CORRESPONDENCE

At present throughout the Porcupine district, interest seems to be centered largely upon milling practice. The Hollinger is having trouble and it is probable that changes will soon be made. The ore is stamped in cyanide solution, the pulp passing to the tube mills, amalgamating pans, Deister concentrating tables and the cyanide plant. In practice it is found that about 60% of the gold goes into solution before the ore is concentrated and amalgamated. The solution produces a bad effect upon the concentrating tables and the management is considering the idea of discarding them and the amalgamating pans; and treating the ore only by cyanidation. At present 30-mesh screens are used on the batteries. It is the intention to reduce these to possibly 10-mesh, and the proposed changes in the mill will not be made until the effect of this coarser crushing has been determined. Indications, however, point to the fact that the cyanide process only will be used.

At the McIntyre it has been found that certain of the ores are not amenable to amalgamation and concentration treatment only, so it has been decided to install a 150-ton cyanide plant. The additional crushing capacity will be gained by using a chilean mill and tube mills. It is understood that the Traylor Engineering & Mfg. Co. has the contract for the work.

The work being done at the Vipond mill where rolls and Hardinge ball mills are used instead of stamps, seems to be coming up to expectations. In this mill the gold is saved by amalgamation only, and a high recovery is obtained by using a large area of plates and by careful amalgamation. The tailings are being impounded in case the company should desire to build a cyanide plant. Despite the excellent results obtained by the small mills, it now seems to have been proved that the best results from Porcupine ores can only be obtained by cyanide treatment, and it is only a matter of time when cyanide plants will be installed in all the mills of the district.

Work has been started on the Dome Lake mill which will have an initial installation of 10 stamps. The process will consist of amalgamation and concentration.

At the Dome mill the results are quite up to the expectations of the management.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their move-

Henry Kaeding is spending a few weeks in Chicago.

Fred T. Williams, of Park City, Utah, left there on July 9, on his way to Alaska.

John G. Worth is on professional business in New Mexico, Arizona, Nevada, Utah, Montana and Colorado.

H. W. Hardinge has just returned to New York from a mining investigation in Lapland, north of the Arctic Circle.

Percy E. Barbour, manager of the Uwarra mine, Candor, N. C., is spending the month of August in New England.

W. H. Storms, state mineralogist of California, visited the Highgrade district in that state in the first part of August.

James L. Bruce, general manager of the Continental Zinc Co., Joplin, Mo., is traveling on the Pacific Coast, on a vacation trip.

Michael Hacket, a prospector, who has spent a year in the Ungava district, has returned without having made any discoveries.

W. S. Tangier Smith has removed from Reno, Nev., to Berkeley, Calif., and will devote his time to general consulting work in geology.

H. F. Widdicombe, general superintendent of the Day-Bristol Consolidated Mining Co., Pioche, Nev., was married, July 29, at Salt Lake City.

Frank M. Estes, of the Exploration Co. of London, is at present manager for the Santa Rosa Mining Co., Ltd., at Concepción del Ore, Zacatecas.

E. Gybbon Spilsbury, consulting engineer of the Southwestern Steel Co., is on a visit of inspection to the company's iron-ore properties in Texas.

J. M. Drake, mining engineer with the Oliver Iron Mining Co., at North Freedom, Wis., has been spending a week in the Michigan copper country.

Prof. Heinrich Ries, of Cornell, was on the British Columbia coast lately, continuing his investigation of the clay deposits of western Canada, for the Canada Department of Mines.

R. G. Davis, in charge of the Pacific division of the topographical branch of the U. S. Geological Survey, has returned to his office at Sacramento, from an official visit to Washington.

J. M. Boutwell is engaged in geological study at Morenci, Ariz. He had recently the misfortune to break his arm, but reports that it is mending rapidly and he will soon be at work again.

H. W. Turner passed through New York this week on his way to California. Mr. Turner has been engaged for a long time in Siberia and the Urals, but expects now to remain in this country.

G. A. Young, of the Canadian Geological Survey, is traveling in the Maritime Provinces in connection with the preparations for the world's convention of geologists, to be held in Toronto in 1913.

David Baker, of Philadelphia, has gone to Australia to act as advisor to the Broken Hill Proprietary Co., in relation to the large iron and steel works, which is to be erected at Newcastle, N. S. W., by that company.

Arthur N. Talbot, professor of municipal and sanitary engineering, University of Illinois, Urbana, Ill., has been appointed second vice-president of the American Society for Testing Materials, to fill a vacancy.

Robert T. Hill and Seth S. Langley announce that they have opened an office in Los Angeles, Calif., for the practice of applied geology and mining engineering. Temporary offices will be in the Hellman Building.

Herbert A. Megraw, late consulting engineer in the City of Mexico, and previously in charge of operations for the Cia. Minera Augustias, Dolores y Anexas, San Luis de la Paz, Guanajuato, has joined the editorial staff of the JOURNAL.

A. L. Carnahan, of the statistical department of Gay & Sturgis, bankers and brokers, Boston, arrived in Houghton, Mich., recently, to spend about six weeks. He will prepare an illustrated guide for the use of the Lake Superior Mining Institute.

Prof. H. N. Herrick has resigned his position as assistant in the mining department of the University of California, and undertaken the construction of equipment for the Craig Mining Co., at Dedrick, Trinity County, Calif. The equipment includes a 40-stamp mill.

George L. Holmes, of San Francisco, consulting engineer for the Union Dredging Co., of Philadelphia, recently visited Merced County, Calif., on professional work for B. C. Warnick, of Philadelphia, who has taken up a tract of land which is being prospected with a view to dredging.

Douglas Lay, superintendent of the Van-Roi Mining Co.'s mine and concentrating mill, in Fourmile camp, Slocan district, B. C., has gone to England on a three months' holiday trip. During his absence D. J. Browne, of the staff of the Le Roi No. 2, Ltd., Rossland, is acting superintendent at the Van-Roi.

F. G. Cottrell, of the San Francisco branch of the U. S. Bureau of Mines, is *en route* to Washington and New York. Doctor Cottrell left San Francisco July 28, and will arrive at New York Aug. 30, and at Washington the following day, returning to New York Sept. 5, remaining there until Sept. 15 or longer. The following places are included in his itinerary: Portland, Tacoma, Butte, Anaconda, Helena, Great Falls, St. Paul, Madison, Chicago, Houghton, Ann Arbor, Detroit, Cleveland, Buffalo, Schenectady and Ithaca.

OBITUARY

William Pollard, head mining captain at the Wolverine mine, was instantly killed by a fall of earth at Hancock, Mich., Aug. 13. He was working about 3700 ft. underground at the time.

Giselli Jesse Liguari died at Redwood City, Calif., Aug. 1, aged 50 years. He had been interested in mining in Mexico for about five years, but is reported to have been driven out by insurgents. He was engaged in the recovery of salt from the waters of the bay at Redwood City, where he had resided for many years. His death resulted from an accident caused by falling timber.

B. H. Burr, president of the Belfont Iron Works Co., Ironton, Ohio, and of the Ashland Steel Co., Ashland, Ky., died in Ironton, Aug. 2. He had been president of the Ashland Steel Co. since the death of J. A. Kelly, a year ago. Mr. Burr was born at Madison, Ohio, 1835, receiving his education in the common schools and a local seminary. In 1857 he went to Ironton and worked at various charcoal blast furnaces in that locality, becoming connected with the Belfont Iron Works in 1866, and gradually rising to become president. He was general manager of the Belfont works for many years. He leaves a widow and two married daughters.

Societies and Technical Schools

Verein Deutscher Chemiker, New York Section—In commemoration of the twenty-fifth anniversary of the parent society, the New York Section will hold a special meeting on Sept. 2, which will also be a reception to members from abroad who will arrive here to attend the International Congress. The meeting will include a business session at which papers will be read by Dr. F. W. Frerichs and Dr. F. Raschig; a luncheon; a theater party for the ladies, and a *Kommers* for the gentlemen at the Arion Club.

University of Washington—Henry Landis, professor of geology at the University of Washington, Seattle, Wash., with a party of nearly 30 students, including the young ladies of his geological class, spent four weeks in June and July camping in Yellowstone National Park, studying the geology of that vicinity. Going thence to Butte, the party was entertained by the Butte chamber of commerce; afterward Spokane, Wash., was visited, and then the journey was continued to Oregon, where, during August, Mt. Hood was to be ascended before the return to Seattle was made.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Aug. 7—The net production of petroleum in California in the first half of 1912, including 182 days, was 41,216,702 bbl., a daily average of 226,355 bbl. In the last half of 1911 the net production was 40,025,720 in 184 days, a daily average of 217,531. This shows an increase in total production in the first half of 1912 over the last half of 1911 of 1,190,982 bbl., and an increase of 8824 bbl. in the daily average production. The total shipments in the first half of 1912 were 36,753,281 bbl., a daily average of 201,941 for 182 days. In the last half of 1911 the total shipments were 35,973,728 bbl., a daily average for 184 days of 195,510; an increase of 779,453 bbl. in the total shipments and 5431 in daily average. This rate of production, with probable increase, continuing for the last half of 1912 should show a total net production of 85,000,000 bbl. for the year. These figures do not include petroleum consumed as field fuel, which is approximately 5,000,000 bbl. per year; nor do they include other hydro-carbon substances. In the first half of 1912 the stocks of petroleum have steadily increased to nearly 45,000,000, at the end of June, 1912. But this is not a serious condition considering the necessary preparation for future markets, though evidence of overproduction. The increase in production for the first half of 1912 may be credited principally to the Lost Hills, Coalinga and McKittrick, the first named being the largest gainer in proportion to the whole gain. In Kern River, Maricopa and Midway fields there were some losses. Santa Maria and other fields in Santa Barbra County show some decline. There was a gain of 250,000 bbl. in La Habra-Coyotes. These wells which gained are operated by the Amalgamated Oil Co. The La Habra-Coyotes came in as a new field this year. Formerly the Murphy production in this field was included with the Whittier report.

Denver

Aug. 7—It has long been inexplicable to those conversant with coal and railway matters how it is that for eight years no purchases of coal tracts have been made in the Yampa coal field, although hundreds of options have been given and hundreds of examinations made. There are 1200 square miles of fine bituminous-coal deposits reported on by engineers and by the U. S. Geological Survey in Bulletin 297; yet no big sales have been made. Though railway facilities are not of the best for immediate operation, 50 ft. of workable seams is equal to about 50,000 tons per acre, and at 1c. per ton in the ground, it would be worth $500 per acre, and during the last eight years it could have been bought for about $100 per acre. Of course the hostility of railroads and their affiliated coal companies with whom this field would come in competition has had its share in preventing sales, but it does not explain why it has not been bought for investment, if not for immediate operation, lying as it does in the exact geographical center of the western states and most of them devoid of good steam coal. However, it is reported here on excellent authority that the first sale of any magnitude in the Yampa coal field of Routt County has just been consumated. Ten thousand acres of bituminous coal have been sold, the purchasers being, it is understood, the McNeill-Penrose interests, whose engineers made a careful examination of the property some three years ago. While the price is not given, the owners have held it for over two years at $75 per acre. The deeds are in escrow and a substantial sum has been paid on account of purchase. The lands are situated, 5000 acres about six miles southeast of Hayden, near what used to be known as the Yellow Jacket section, and 5000 acres about eight miles southwest of Hayden, in the Sage and Dry Creek section. This transaction involves a sum of about $750,000. The leading spirit in the sale is Albert Allen, of Colorado City.

The co-operative pumping plan organized last year at Leadville, and chronicled at the time in the columns of the JOURNAL, seems to hang fire. The Leadville Mines Pumping Co., through its directors, has advised the owners of mines on east Fryer Hill that unless contracts are signed by Aug. 1, the plan to drain the district by pumping will be abandoned. A circular letter to that effect has been sent out by the Central Colorado Power Co. These contracts provide for the mine owners resuming operations upon their properties or leasing them or giving the company the right to lease them. The company was organized last year by a subsidiary of the Central Colorado Power Co. for the purpose of bringing about coöperation between the east Fryer Hill mine owners in a plan to unwater the district. The company proposes to drain the water basin and thereafter to maintain permanent pumps.

It is reported that nickel-sulphide ore has been discovered near Kremmling in Grand County on the Moffat Road. Much copper float has been found from time to time near Kremmling on the Grand River. The discoverers were having the ore tested for copper with no results, but one of the assayers reported that the ore was millerite.

Butte

Aug. 7—With a view to increase the efficiency and to effect a further saving in the operation of the Great Falls smeltery of the Anaconda Copper Mining Co., a new converter, undoubtedly the largest ever built, has just been blown in as an experiment. The converter was made at Great Falls; the castings at the Great Falls Iron Works, the plate and metal work at the shops of the smeltery. The diameter is 20 ft., the bearings each weigh 13 tons and the wind box is 7 ft. high. The converter weighs 65 tons, not including the gears and bearings. Forty tons of copper was produced at its first trial, and it is figured that with a full load it will produce about 50 tons. B. B. Thayer, president of the Anaconda company, and C. W. Goodale, general manager of the smeltery, arrived at Great Falls from Butte, Aug. 4, and spent the following day observing the operation of the converter, which thus far has been entirely satisfactory.

The Anaconda company's recently-made offer of an increase in wages to the Anaconda and Great Falls smeltermen has been accepted by both organizations, and a three-year contract has been entered into between the company and these unions, calling for the payment of 25c. per day increase over the old scale, as long as copper remains at or more than 15c. per lb. An offer of wage increase, identical in every respect to that made the smeltermen, has been made to, and accepted by, the members of the machinists, structural-iron workers, boiler makers, electrical workers, carpenters, plasterers, blacksmiths, molders and pattern-makers' unions. About 300 employees will receive the increase.

As a further proceeding in the deficiency judgment for $89,000, held by Shirley Jenks, of London, against the British Butte Mining Co., the placer claims of the company, eight in number, were sold at a sheriff's sale July 22, for $5000, to

an attorney for Jenks. Recently the company's dredge, valued at $100,000, was sold to Jenks for $1000 in the same manner.

Kingman, Ariz.

Aug. 7—The supreme court dismissed the appeal by the plaintiff in the case of Peachy against the Frisco Mines & Power Co. and others, thereby sustaining the ruling of Judge Doe of the lower court. The property involved was formerly known as the Gold Crown group and was owned by O. D. M. Gaddis and associates from whom it was purchased by the company named. The recent legal action arose from the fact that the former owners, during the period of their ownership, had relocated a portion of the ground held by location. Peachy, the plaintiff in the suit, subsequently located upon the same area, contending that one could not make a valid relocation of his own claim; that the action of Gaddis and associates in doing so was tantamount to an abandonment of the property. The Frisco Mines & Power Co. had spent about $150,000 on the development and improvement of the property, as a result of which, the value of the mine was estimated at about $3,000,000 before Mr. Peachy brought action seeking to have the company restrained from further work and a receiver appointed. Judge Doe decided in favor of the defendants, the Frisco Mines Power Co., and, as stated, the supreme court of Arizona has sustained his decision.

Salt Lake City

Aug. 8—At a meeting of Utah mine operators and mining men, held at the Commercial Club, Aug. 2, resolutions were adopted, urging the Secretary of the Interior to grant a rehearing of the East Tintic case. Other resolutions, urging a revision of the mineral-land laws, were passed, and a resolution was also adopted requesting the Secretary of the Interior to make Salt Lake City the headquarters for government inspectors in the mineral-land department, operating in Nevada camps, instead of Denver or San Francisco. The resolution regarding the East Tintic case was as follows:

"Whereas, the recent ruling by the Department of the Interior in the matter of the mineral entry by the East Tintic Consolidated Mining Company establishes a precedent that will have a tendency to discourage prospecting, to unsettle mining titles, and retard development of latent mineral resources; therefore be it resolved, by the mining interests of the State of Utah, that an appeal be made to the Honorable Secretary of the Interior that he be and is hereby memorialized to grant a rehearing of the East Tintic case, and to formulate a ruling that shall reiterate the policy of granting patents on lands known to be more valuable for mining than for other purposes to all entry men, who have occupied claims in good faith, and who have otherwise complied with the law and with local customs and regulations."

This resolution was adopted, and copies of it sent to the Secretary of the Interior and to Utah's delegation in Congress. A second resolution presented by the committee to the effect that inasmuch as the mineral-land laws of the United States are inadequate in their details and need revision in order to promote the welfare and development of the mineral industry, the mining interests of Utah favored the creation by the Federal government of a commission of mining men, whose duty it would be to ascertain what changes in the laws should be made, and that legal applications for patent by citizens acting in good faith be granted by the government. Speeches were made by E. L. Wolcott, John Dern, G. W. Riter and others, calling attention to the adverse conditions now prevailing, and to the necessity of Utah mining men completing an organization that will give care and attention to the needs of the industry. The question of supporting the American Mining Congress or of forming an independent Utah association was discussed, and will be further considered.

Negaunee, Mich.

Aug. 9—The new steel and concrete ore dock has been completed at Marquette by the Lake Superior & Ishpeming Ry., which corporation is controlled by the Cleveland-Cliffs Iron Co. and the Jones & Laughlin interests. Construction was started Mar. 1, 1911. The cost is estimated at $1,250,000; 60,000 bbl. of cement and 5000 tons of iron and steel were used. The ore spouts will be lowered and raised by electric motors. There are more than 100 double ore pockets. The new dock is situated next to the old wooden dock of the company north of Marquette, near Presque Isle. Shipping from the new dock has started, although only one-half of the pockets will be used for the first week or two.

The recent strike of the dockmen at the Lake Superior & Ishpeming Ry., and Duluth, South Shore & Atlantic Ry. docks, has been settled by allowing the men a raise from $2.25 to $2.50 for day-shift men, and from $2.35 to $2.65 for night-shift men.

The mines in the Iron River district have now an opportunity to buy cheap electrical power from the Peninsula Power Co., of Iron Mountain, a corporation composed of Michigan and Wisconsin men, with O. C. Davidson, president. A temporary steam power house has been erected at Iron River and power is being furnished to the Wickwire mine and the Davidson mine. The water-power plant on the Menominee River, near Iron Mountain, is being hurried to completion. Three turbines, of 1250 kw. each, are being installed and two more will be put in later, when there is a demand for them. The head is 40 ft. The current generated at 6600 volts will be stepped up to 66,000 volts for transmission to Iron River, 30 miles away. There will be two sets of three wires each, strung on 40-ft. steel towers, set 500 ft. apart. The wires are standard aluminum, with a steel-wire center. The right-of-way has been secured by Hon. L. T. Sterling, of Iron Mountain, and the concrete bases for the towers are being put in. A permanent station will be erected at Iron River, and when the water-power current is ready for delivery, the present steam plant will be used only in case of emergency. The steam plant is equipped with a 625-kw. turbine generator unit and three Morrison 150-hp. boilers; current is generated and distributed at 6600 volts.

Toronto

Aug. 10—The mining interests of British Columbia have been bringing strong pressure to bear on the Canadian government for the establishment of a department of mines, separate from the Department of the Interior, of which the present Department of Mines is an adjunct. It is proposed to create a new portfolio, as the work of the Department of the Interior has so largely increased, that mining matters cannot be efficiently looked after in connection with it. The position of Minister of Mines will almost certainly be given to a Western man.

A shipment of 44 ingots of pure silver from the Cobalt mines, each weighing 80 lb. Troy, the consignment being valued at about $24,000, was made from Montreal today by the White Star liner "Teutonic" to the Bank of England. It will go to the British mint for coinage.

At Cobalt, John McLean and Frank Gilmour were convicted, on Aug. 8, of stealing bullion from the Nipissing mine and sentenced to two years' imprisonment each. The method employed was ingenious: One of the prisoners who worked in the refinery where bullion was melted would dip a cold, steel bar into the molten metal, when some of the silver would congeal around the bar. Several pounds at a time were obtained in this way. A quantity of bullion was found secreted in the houses occupied by the prisoners.

There bids fair to be a rush of prospectors for the portion of the Gillies Limit, south of Cobalt, when it is opened Aug. 20. About 20 parties have already gone there in readiness, and some have anticipated the official opening, by surveying claims to be staked as soon as the day arrives. Some doubt exists, however, as to whether the output of the Gillies Limit mines will be subject to royalty, and many are awaiting a definite statement from the Department of the Interior on this subject before taking action. A statement as to the conditions on which claims in this field may be taken up, will shortly be issued.

The Mining News

The Current History of Mining

Alaska

Alaska-Mexican—During the month of June the mill ran 30 days, crushing 19,299 tons of ore, from which $64,259 was recovered at an operating expense of $28,399. The estimated operating profit is $35,860, the construction expenses $7705, the estimated net profit $28,155. The yield was $3.36 per ton of ore milled.

Alaska-United—During June the mill ran 30 days, in which time 18,018 tons of ore was crushed from the Ready Bullion Claim mine, from which $49,786 was produced at an operating expense of $24,735, leaving an operating profit of $25,051. Construction expense amounted to $1871, leaving the estimated net profit as $23,180. On the 700-foot Claim mine, 19,236 tons of ore was crushed, which yielded $52,586 at an operating expense of $23,036. The estimated operating profit was therefore $29,550; the construction expenses $4016, leaving $25,534 net profit.

Arizona

Gila County

Arizona Commercial—Development at this mine is proceeding as rapidly as is possible until the new equipment shall have been installed at the Copper Hill shaft, which will be in two or three months. The enlargement of the shaft to three compartments continues above the fourth level, and some repair work is being done on that level. The compressor at the Eureka shaft has been moved to the Old Dominion power house, and a 5-in. pipe line is being laid from that point to the Copper Hill shaft for the transmission of compressed air.

Miami—The production for July was a little over 3,000,000 lb. of fine copper, the highest monthly production in the history of the mine. There was mined during the month 96,403 tons, and 4942 ft. of drifts and raises were driven. A third 8-ft. Hardinge pebble-mill has been added to the equipment of the fourth unit of the concentrator, affording a slight increase of capacity. It is believed that monthly production will hereafter be maintained close to the 3,000,000 mark. A large proportion of the ore mined comes from square-set mining next to the capping and from development work; the rest from the shrinkage stopes and from the dump at No. 2 shaft. The new machine shop at No. 4, or main shaft, is finished and is being equipped, and a building to contain the mine office and the engineering office is nearing completion. Also a contract has been let for the steel work for a large new change house, 57x90 ft., two stories high, and designed to accommodate 650 men. Exploration by diamond drilling continues on the 570-ft. level, but considerable difficulty is experienced in obtaining a core. The northeastern territory is being explored with two churn drills. About 1000 men are employed, of whom 550 are underground.

Inspiration Consolidated—The contract for railroad construction has been let to McArthur Bros. and ground should be broken within the next two or three weeks. The development of the mine is proceeding at the rate of 4500 ft. per month. The two main working shafts are being sunk. The first haulage level is being opened at many places, the ore being hoisted through the Joe Bush shaft. Stations and ore pockets are being cut at the first haulage level in the Scorpion and the Colorado shafts, and an incline is being driven from the main tunnel to the surface. After that is finished, a hoist will be erected and the incline will be sunk to the haulage levels and will be used exclusively for men and timbers. At the Live Oak mine, a pumping station is being cut at the 1160-ft. level in No. 2 shaft and a steel headframe is being erected at No. 1 shaft, after which the sinking of that shaft will be resumed. The Sulphide tunnel is being widened to 7½ ft. and will be equipped with double track for electric haulage.

South Live Oak—Churn-drill hole No. 2 has been discontinued at a depth of 755 ft. in the granite porphyry without discovering chalcocite, although silicates and carbonates of copper were noted at various times. The drill is being moved to the hill on the schist area at the northern end of the property adjoining the Needles group and it is expected that hole No. 3 will be started within a week.

Old Dominion—This mine produced 1106 short tons of blister copper in July. Engineers under H. Kenyon Burch are working on the plans for the concentrator. Proposals for steel work and machinery are in, but no contracts have yet been made. Construction will probably be started within two or three months. The concreting of the last section of the Kingdon shaft has just been started and the job should be finished in about two weeks. The section is 135 ft. deep and the last three weeks have been spent in enlarging it from one to two compartments. The work is being done by Michaelson & Weideman, construction engineers and contractors. A change is to be made in the management, which will be announced in a few days.

Pima County

Calumet & Arizona—The steam-shovel property which this company is developing was taken under option from the New Cornelia Copper Co. in the Ajo district, and includes some land adjoining the claims of that company. The district is 42 miles south of the station of Gila on the Southern Pacific R.R. The surface showing is copper-stained monzonite. The preliminary prospect holes showed siliceous carbonate ore to a depth of 30 to 100 ft. below the surface. Below this low-grade surface ore disseminated ore of good grade has been found. The ground is now being drilled systematically to explore for concentrating ore.

California

Amador County

Mountain King—A 13-ft. shaft has been sunk on this prospect at Pine Grove, disclosing high-grade ore. A large amount of gold was taken from the property a few weeks ago, and attracted attention to this section.

Kennedy—Underground work through the east shaft has been suspended in order to make repairs to engine and hoist. The underground work is in progress through the north shaft. The 100-stamp mill is running at full capacity on accumulated ore.

Butte County

Oro Electric Corporation—One hundred men are employed in Humbug Valley at road construction preparatory to the initial work on the power plant to be constructed. Feather River will be bridged at Belden with a bridge ¾ mile long. The construction camps will be built this summer. The plant when completed will extend power to the mining districts in Butte and adjoining counties.

Calaveras County

Christensen—The shaft on Stockton Hill is being unwatered. This shaft was sunk to a depth of 145 ft. in 1852. The work was abandoned on account of heavy flow of water. The property was reopened a year ago, but work was suspended on

account of a cave-in. A rich shoot of ore is reported to have been disclosed. C. G. Nuner, manager.

Waterman—Machinery and materials are being shipped to this mine at Angels Camp, with a view to systematic operating. The property was recently purchased from W. W. Waterman by Los Angeles men. It was once a producer.

KERN COUNTY

The Sierra electric-power line has been completed to Randsburg. The majority of the mines in the district will install electric power.

Blackhawk—This mine has installed electric power and is one of the first in the district to do so. Ore is being blocked out on the 60-ft. level and several tons of smelting ore are on the dump. D. A. Blue, owner.

King Solomon—Thirty-five tons of high-grade ore has just been shipped to the Red Dog mill. The new shaft on the Teagle-Lamberson lease on this mine has been completed to the 75-ft. level, and the necessary equipment has been installed for continuing the work of exploration. The drift on the 75-ft. level shows a strengthening of the vein as the drifting advances. Ed Shipsey, owner.

Butte—Fifty tons of ore has been extracted ready for shipment to the Red Dog mill. The new lease on the west end has been taken and drifting begun on 120-ft. level.

Parallel—Machinery and parts for construction of a 3-stamp mill has been received.

MODOC COUNTY

Sunshine—The first shipment of ore from the Highgrade district was sent in July from this mine to Selby. The returns from the carload showed $238 per ton on 28,498 lb., a total of $3392. Freight on 30,000 lb. at $13.20, was $198, leaving a net value of $3194. An assay showed gold 12.095 oz., silver 21.13 oz. per ton.

Bidwell Consolidated—Suit has been brought against this company by the Mountain View owners, who claim that the Bidwell is working in Mountain View ground.

NEVADA COUNTY

Pittsburgh—Development has been completed to the 1500-ft. level. The 20-stamp mill is running steadily on reserve ore. The shaft will be deepened to 2000 ft. M. B. Kerr, manager.

Mountaineer—Development is in progress on the south 400-ft. level. The drift is in ore all the way. F. J. Sloat, of Nevada City, superintendent.

California-Montana—Electric power is being extended from the Pittsburgh mine to this property. The line will also serve the Murchie. There are other mines along the line that will no doubt substitute electric for water power. Some good ore has recently been taken from the mine, which is being operated by Eastern men.

Maryland—Richard Morcom and John Bawden were imprisoned in the west 700-ft. level from Saturday afternoon till Sunday morning, Aug. 4. They were shut in by a cave-in at the mouth of the stope. The accident was not discovered until 9 p.m., Saturday, when Supt. Robert Nye discovered the change clothes of the men in the dryroom. The men were uninjured, and were in good air.

Colorado

CLEAR CREEK & GILPIN COUNTIES

Humming Bird—The workings of this Soda Creek property are being cleaned out and repaired preparatory to further development..

Tennessee—This company is developing a group of eight claims in Chicago Creek. The main tunnel is 516 ft. long.

Silver Horn—Operations have been resumed at this property in Ute Creek. A narrow streak of gold and silver ore has been struck on the 100-ft. level. The shaft will be unwatered to the bottom of the 200-ft. level.

Idaho Bride Mining & Milling Co.—This company will develop the Bride property on Seaton Mountain near Idaho Springs. The company is now actively engaged in sinking a two-compartment shaft on the Bride vein west of the Idaho tunnel. John J. Hoban, president and manager.

Anamosa and Bellevue-Hudson—These two properties are on Columbia Mountain, near Empire, and both are controlled and operated by G. W. Boyce, of Denver. The Anamosa is opened by a tunnel 1000 ft. in length, which has opened a vein of silver-lead ore. An air compressor and machine drills have just been installed. The Bellevue-Hudson is opened by a tunnel 1200 ft. in length and in a shaft 200 ft. below the tunnel level a streak of silver-lead ore has been opened, on which stoping has been commenced.

Comet—This mine, on Griffith Mountain, credited with a production from the surface down to 400 ft. of 500,000 tons, is reported sold to Dr. Charles Rowlands, of Syracuse, N. Y. It will now be developed at depth by a crosscut tunnel.

LAKE COUNTY—LEADVILLE

The output from Leadville during the last two months has been curtailed by the wet summer and an enormous amount of surface water, which filled many shafts that were not equipped with pumping plants, closing down many of the smaller properties and causing much trouble and expense to the mining industry in general.

Little Miami—Shipments of lead ore, which had just been opened in this mine on Fryer Hill, have been temporarily suspended, owing to the accumulation of water in the shaft.

Belle of Granite—This property is about 18 miles from Leadville, and is owned by the Loyal Mining & Milling Co. The mine is now being unwatered, smelting and milling ore being produced. The property has a 25-stamp mill and milling will be begun about Aug. 15. It is operated by Smith & McKirahan.

SAN JUAN DISTRICT

Tomboy—During July the mill was in operation for 20 days crushing 10,000 tons of ore, that yielded bullion worth $18,500 and concentrates worth $80,500. The expenses for the month were $42,-500, the profit $56,500, and the amount of $16,603 was spent on permanent improvements.

TELLER COUNTY—CRIPPLE CREEK

It is reported that the Eclipse claim has been sold to the El Oro Gold Mining Co., of which Robert Mullen is president and manager. It is planned to buy the Rex mill on the Homestake mine and move it to the new site.

El Paso—There is said to be more ore in sight now than in many years, as rich ore was opened at the Roosevelt tunnel level, which extends upward for several lifts. The output for July is 125 carloads by lessees and on company account, the net profits being given as $40,-000. The yield in gold is greater than usual on account of the high grade of the ore from the 1000-ft. level. The shoot has been opened for 350 ft.

Ajax—The Colburn mill, using the Clancy-Moore process, which was closed two months ago for alteration and repairs, will be started again about September 1, and the mine is to be reopened to lessees this week.

Stratton's Independence—During June, 2967 tons of ore of an average grade of 13¼ dwt. was produced, and 10,800 tons low-grade, mine and dump ore was milled. The working profit was $23,275.

Louisiana

Eureka Oil & Gas Co.—This corporation has made arrangements to bore for oil on Point au Barrée, about 16 miles south of Houma. A contract is being negotiated to commence boring immediately.

Michigan

COPPER

Naumkeag—Drilling with two diamond drills is in progress. One is at the north and the other at the south end of the company's property. This work has been underway for some time, but results are withheld.

Franklin—The Western Federation of Miners is reported to have been intimately connected with the recent labor

troubles at this mine. Work has been resumed and conditions are now satisfactory.

Victoria—The company is erecting houses for trammers, of whom there is a great scarcity in this district.

Hancock—This company's shaft is again bottomed in copper at a depth of about 3775 ft. The shaft has been in a mineralized zone for several hundred feet and it is believed by many that the Quincy-Pewabic series of lodes has been reached, but the management is reluctant about making any statements regarding this and plans are to continue sinking to a depth of about 4000 ft. when drifting will be started and the various formations developed.

South Lake—This company has finished the concrete work from the mouth of the shaft down to the vein, a distance of about 80 ft., and sinking can now go forward without interruption. The shaft will go down to a depth of about 600 ft., when a crosscut will be driven to reach the lodes encountered in drilling.

Ojibway—This company is developing some ground tributary to No. 1 shaft at the 1500-, 1600- and 1700-ft. levels. At No. 2 shaft a crosscut is being driven to explore the territory to the west of the shaft.

Copper Range Consolidated—The production of the Baltic, Champion and Trimountain for July and for the first seven months for the year 1912, were in copper mineral, respectively as follows: 926 and 6568 tons; 1245 and 8155 tons; 423 and 3864 tons.

Mohawk Mining Co.—The July production was 601 tons of mineral, making the total for the year 3584 tons.

Wolverine Mining Co.—The production for July was 401 tons of mineral, making the total production for 1912, 3443 tons.

Ahmeek—A plat has been cut, and drifting is now underway on the 18 level at No. 2 shaft. The concrete shipway is now being laid to the 19 level.

Franklin—The output for July was 79 tons of mineral, making the total to date for the year 927 tons. The stamp mill was closed down all but nine days during the month, on account of a strike of employees.

Quincy—The output of mineral in July was 1252 tons, making the total for the year 8821 tons, which compares with 1300 and 9292 tons for the same period in 1911.

Adventure—It is reported that a new lode on the 1500-ft. level was recently discovered in a crosscut which is being driven to the southward. The new lode was cut at a distance of 1220 ft. from the shaft, just beyond No. 3 lode, and the crosscut has been advanced a distance of 12 ft. into the lode.

Iron

American—The machinery for the concentrator, which is being erected by the Denver Engineering Works Co., near Marquette, has been received, and will be put in place as soon as possible. If the concentrator proves to be a success in treating the low-grade ores at this property, similar structures will undoubtedly be installed at other mines in the district where there are large deposits of ore containing about 40% iron.

Republic Iron & Steel Co.—It is announced in Negaunee that operations are gradually to be increased at this company's Hartford, Cambria and Lilly mines on Teal Lake. The Hartford shaft will be sunk 350 ft., or below the 975-ft., level, and 1400 ft. of crosscutting and drifting will be done to develop lower levels. In about two months, the management expects to take on several hundred men; the present force numbers 50. The Hartford mine was taken over two years ago from the Oliver Iron Mining Co., principally for the use of its shaft and steel headframe for hoisting from the adjoining Cambria and Lilly mines. It has been closed since May, 1911, when seven men were killed by an underground fire, but has been kept pumped out. The Lilly is the only one of the three which has been operated this season, and that only in a small way. Considerable diamond-drilling has been done at the Cambria and altogether the three mines are estimated to contain about 1,000,000 tons of ore. They have produced a total of 7,000,000 tons of hard, non-bessemer ore of about 58% iron and 0.09% phosphorus.

Minnesota

Cuyuna Range

According to the director, the U. S. Geological Survey will coöperate with the state of Minnesota to make a complete topographic survey of practically all of Crow Wing County except the extreme northern part.

Mesabi Range

Mines in the Hibbing and Canisteo districts have been hampered by a shortage of cars due to the fact that the boat dispatch at the Head of the Lakes has not been up to the usual standard.

Great Northern—The present plans of this company include stripping three iron-bearing tracts and bringing them into the producing stage as soon as possible. The most important of these tracts lies directly east of the Monroe, a stripped property of the Steel Corporation, and south of two small tracts of Great Northern property. The Monroe is stripped to the line of the section and a slight amount of overburden has been removed so that the Great Northern will benefit somewhat by the development of the adjoining property of the corporation. Contracts for the stripping of 5,000,000 yd. have been let. The property is owned in fee by the estate of J. S. Pillsbury, of Minneapolis. There is a royalty of 25c. per ton to the fee owners with a minimum annual output of 100,000 tons. Contracts are to be let for the stripping of the Woodbridge or second tract. A portion of this land is held in fee by the public-school fund of the State of Minnesota, and the state will receive a royalty of 25c. per ton on the ore. A third tract, belonging to the state, adjoins the Mahoning property and likewise will pay a royalty of 25c. per ton to the school fund.

Missouri

Joplin District

Aurora—A pumping campaign is being started at this mine by the United Zinc and the Boston-Aurora companies to redeem flooded ground. Two 5-in. Texas Wonder pumps have been installed.

Lincoln—This mine at Duenweg, southeast of Webb City, is in operation, after a year of idleness. The mine is in thin sheet ground and has been handicapped by a heavy flow of water from a large cavern. The mine is equipped with a complete concentrating plant.

Coahuila—One-man machines have just been installed at this mine, near Porto Rico. They are of the latest Sullivan type and take the place of the heavy two-men machines. The new machines will be kept in the headings, two heavy machines being used to drill the stope. This is the first large installation of one-man machines in the district and their work will be regarded with much interest.

Little Mary Mining Co.—This company, in the Alba, Neck City, Purcell district, is now producing 10 tons of blende per week.

Happy New Year—This mine, at Granby, is being reworked, good milling ore being found in the heading. The mine was worked in the early days when only the rich ore was gouged out.

Granby Mining & Smelting Co.—A new mine is being opened up and worked by this company. A shaft known as the Ida M., one mile southwest of the custom mill, has been sunk 81 ft., where a 10-ft. face of blende is found. Thirteen drill holes have been sunk on the property.

Hartford—At this mine, south of Galena, plans are being made to remodel the concentrating plant and increase its capacity. Electrical drive will supersede steam power. Harlan H. White, manager.

Sunrise—A rich discovery of lead and zinc ore has been made on Pierson Creek near this mine at Springfield. It is reported that the ore is found at a depth of 70 feet.

Montana

Butte District

Bullwhacker—It is reported that negotiations are being made for control of the property between Patrick Clark, owner of the Bullwhacker mine just west of the Brundy group of claims recently bonded to Capt. Wolvin and associates, and Eastern men. If the deal is made, it is planned to sink to the 1000-ft. level in order to go below the carbonate into the sulphide zone.

Silver King—At a distance of 220 ft. from the shaft on the 300-ft. level, in the heart of the city of Butte, a block of ore has been discovered. The mine is part of the Davis-Daly property, and is being operated on a lease. It is thought that the crosscut being driven from the Gagnon mine, to develop this ground, will intersect the same vein at a depth of 1800 feet.

Tramway—This mine, which has been closed for the last two months for the purpose of equipping it with compressed air, has been placed in commission, while the Pennsylvania has been closed to receive the same treatment, which will require about six months. The underground electric haulage system will soon be in general use throughout the Mountain View mine. Some horses are yet in use, but within another month it is expected that all haulage will be done by electrically operated cars.

Davis-Daly—Developments of the last few days on the 1900-ft. level are reported to be especially encouraging. It is said that the stringers indicate that the crosscut being driven to the north vein is approaching another orebody. This crosscut has intersected two orebodies already; the main vein lies ahead.

East Butte—It is not probable that any increase in copper production will be made for a month or more, because of the delay in the delivery of steel for the extensions of the blast furnaces. The recently installed improvements have resulted in many economies and it is probable that the company will be able to liquidate the indebtedness incurred by the purchase of the Pittsmont mine and smeltery, in little more than a year. The ore now blocked out between the 800- and 1000-ft. levels should be sufficient to maintain double the present production for several years.

Butte & Superior—The second unit of the mill has been completed, and the company is in a position to treat more than 1200 tons of ore per day. The first unit has been successfully operated for two or three months, and the second unit has been found to be fully as satisfactory. The mill is now treating about 600 tons of ore per day, and this amount will be maintained until the new surface plant now under construction, has been completed, which should be about Oct. 1. A high recovery of the zinc is being made, and a little more than 200 tons of concentrate is being shipped daily to Bartlesville, Okla., for smelting. Development work is going ahead steadily, and it is figured that ore enough is blocked out to keep the concentrator going at full capacity for several years.

Broadwater County

Irish Syndicate—A strike of high-grade silver-lead ore was made recently in the Syndicate tunnel, which has been advancing on the vein for a year. The property is seven miles south of Winston.

Jefferson County

Charles Dungess, and the Ballard brothers, are operating gold properties east of the Yellow Jacket property, and making occasional shipments of ore to the East Helena smeltery. The Ballards have a large, low-grade vein in which are shoots of rich gold ore.

King Solomon—At this mine in the Lump-Clancy district, a crew of men is drifting on the vein.

Sheep Mountain—A new shaft is being sunk on this property in the Lump-Clancy district, to open workings known to contain rich silver ore. The old shaft sunk many years ago is unsafe.

Yellow Jacket—A crosscut tunnel is being driven on this property, south of Helena, to intersect eight known veins at a depth of approximately 800 ft. Machine drills operated with power furnished by the Missouri River Power Co., are being used to drive the tunnel.

Nevada

Comstock Lode

Mexican—The new mill is now producing bullion at the rate of about $50,000 per month, and has practically wiped out its floating indebtedness. Funds will now be accumulated in the treasury for dividend purposes. The 2500-ft. level of the mine is producing the highest grade ore, while rich ore is being stoped from two places on the 2400-ft. level.

Ophir—Run 38 on second-class ore at the Kinkead mill has been completed, and a clean-up made. Concrete foundations are now completed for the 100-ton cyanide plant, and the framework of the building put in place. On the 2500-ft. level, the west crosscut from the main southwest drift is in vein porphyry.

Consolidated Virginia—Understoping is underway on the 2400-ft. level below the sill floor sets of the three-compartment raise. The vein, eight feet below the sills, dips more to the east than it does above.

C. & C. Shaft—It is announced that in about two weeks, the new temporary pumping plant will be in operation, tests on the new 2300 station pumps, showing them to be in excellent condition for regular service. A vertical centrifugal pump will be lowered to the sump and will pump to the 2300, from which level the water will be relayed to the 2000 and from there to the Sutro tunnel at the 1600-ft. level. The sump pump will replace the hydraulic elevator temporarily, until the main hydraulics are installed on the 2500 station.

Combination Shaft—This shaft has now been retimbered and placed in good condition from the surface to 60 ft. above the present water level just below the 1700-ft. level.

Elko County—Jarbidge

Bluster—Work on both the 100- and 250-tunnel levels is progressing favorably. One crosscut on the upper level shows milling ore. On the lower level the oreshoot to the north of the tunnel is being drifted on and continues to carry fine gold.

Buckeye—A new adit has been started on the vein about 150 ft. below the former adit and close to the side line of the claim. It is probable that with the Last Chance a common tunnel on the latter property will be run by which about 1000 ft. greater depth can be obtained.

Alpha—The vein has been picked up beyond the break and is beginning to show gold again. A 6-hp. Fairbanks & Morse gasoline hoist has been erected at the shaft and sinking has been in progress for over a week. The showing in the bottom of the shaft is good.

Humboldt County

Mazuma Hills—This mill was destroyed by fire July 29; water protection was not available on account of the recent cloudburst.

Lyon County

Mason Valley—The work of enlarging the No. 2 furnace at Thompson, is proceeding steadily and should be completed soon. When this work is finished the No. 2 furnace will be blown in, while No. 1, which is now in operation, will be blown out, and the work of lengthening and enlarging it will begin. When these alterations have been completed, the two furnaces will have a capacity of 1850 tons per day, as against an original rated capacity of 400 tons each, or a total original capacity of 800 tons.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Aug. 1, are as follows:

Mines	Week	Year to Date
Tonopah Mining	4,100	103,869
Tonopah Belmont	3,755	65,231
Montana-Tonopah	981	31,566
Tonopah Extension	1,055	30,403
West End	820	22,169
Midway	40	340
MacNamara	.....	10,935
North Star	50	130
Totals	10,801	264,643
Estimated value	$270,025	.....

Tonopah Extension—The clean-up at the mill for the month of July shows that 4503 tons of ore was treated for 5611 lb. of bullion valued at $63,200, the extraction being 92 to 94% of the assay value. The new vein on the 500-ft. level is in a contact between rhyolite and breccia and is geologically, the deepest vein in the western ore zone.

Jim Butler—Shipments to the old Belmont mill were commenced Aug. 10.

New Mexico

Grant County

Chino—The production for July amounted to 3,100,000 lb. and the cost is stated to be 6.23c. per lb. The ore contained about 44 lb. copper per ton of which about 30 lb. was recovered.

Burro Mountain Copper Co.—This company is again operating, having a force of 50 men employed to which it is adding daily. It is sinking the main working shaft.

Socorro County

Deadwood—At this mine good time was made in the erection of the new headframe and the resetting of the hoisting engine. The new 50-hp. auxiliary engine for the mill is about ready for operation.

Oaks—The development on the Pacific and Johnson mines of this company produced 70 tons of ore, which was sent to Deadwood mill, recently.

Deep Down—Lessees continue to send a good tonnage of ore to the custom mill.

Socorro—This company has recently completed special ore bins and is now receiving custom ore regularly. A large flow of water was recently encountered in the 500-ft. level on the Queen vein, flooding the 700- and 800-ft. levels; a concrete bulkhead is being put in to stop the flow.

Ernestine—For the last 20 days of July 17,760 oz. of gold and silver bullion was smelted, with a concentrate product of over 8½ tons. The total output for the month was 27,460 oz. of bullion and 14 tons high-grade concentrates. Ore treated during the last week was 590 tons, the low figure occasioned by reconstruction work on old battery of 20 stamps, which will be completed about the end of the month.

Iron Group—About 75 tons of ore has been delivered to the Deadwood for treatment. Several men are at work on the property and as it is large, and as good results have already been obtained, it promises to become an important factor in the district's growth and production.

Mogollon Gold & Copper Co.—The Little Charlie mine continues its shipments to the custom mill and the grade is probably the best of any ore now being milled in camp.

Pennsylvania

It is reported that it is almost impossible to secure manganese for prompt shipment for Pittsburgh consumption. Foreign production is behind contracts because of the impossibility to make shipments due to the blockade of the Dardanelles.

Cambria Steel Co.—During July the plant at Johnstown turned out 25% more steel than in any previous month in its history. All the blast furnaces are now in blast and three additional openhearth furnaces now under construction, will be fired about October 1. These furnaces have a capacity of 75 tons each and will make a total of 28 openhearth furnaces.

South Dakota

Lawrence County

Black Hills Standard—This company has been organized to take over the property of the Deadwood-Standard, Spearfish and Slavonian mines. The Deadwood-Standard had a small cyanide mill, which has been refitted and is now in operation. The ore occurs in the carboniferous limestone and yields readily to simple cyanidation. The officers are: John Gray, president and general manager; Paul Rewman, secretary and treasurer; Edward Manion, superintendent. All of the officers are Black Hills men.

Ruby Mining Co.—At a meeting of the stockholders of this company, the following directors were elected: Mrs. James Conzette, president; Arthur M. Hanna, vice-president; Norman T. Mason, secretary, and Rollin Maxam, treasurer. The company owns property in Ruby Gulch, near Galena, which is equipped with a small mill.

Homestake—Doing away with steam power, a 150-hp. Ingersoll-Rand air compressor has been installed in the machine shop to operate the many machines which have heretofore been operated by steam engines. This is another application of the power generated at the hydro-electric plant on the Spearfish River. A crew of men has been sent out to replace the old, worn-out flume from Little Elk Creek with a new installation, constructed to withstand the action of the elements. The work of construction is in charge of George Northland.

Golden Reward—At the annual meeting of the company, held at Deadwood, the following directors were elected: A. G. Hackstaff, C. C. Tegethoff, O. H. Kahn, Harris Franklin, Robert W. Goelet, George G. DeWitt, Henry W. DeForrest, W. B. Devereux and Walter Luttgen. Work is progressing favorably on the roasting plant, and the leasing system lately introduced at the mines on the north end of the property is proving satisfactory to the management.

Hidden Treasure—The annual meeting of this company, held at Deadwood, resulted in the election of the following officers: S. T. Cochran, president; J. N. Andrews, vice-president; R. S. Grimes, secretary; Banks Stewart, treasurer and general manager. It was decided at the meeting to continue the main tunnel to cut a vein which was also the objective point of a shaft, but no work will be done there at present.

Pennington County

Forest City—W. J. Blake, of Hill City, who is operating this property, has just started the 10-stamp mill, after installing a gasoline pumping plant on Palmer Gulch, 2000 ft. distant, to secure water for milling, the mine workings failing to furnish the necessary water. The mine shows an ore shoot of free-milling ore.

Deadwood Zinc & Lead Co.—This company intends building a reduction plant and will try electric furnaces for the treatment of complex ores.

Utah

Juab County

Tintic shipments for the week ended Aug. 2 amounted to 193 cars. This is 200 tons more than for the week preceding, and is above the average. Increase in shipments was made by the Centennial-Eureka, Iron Blossom, and Grand Central.

Chief Consolidated—A report dated July 23 covering operations for the first half of the year has been issued. There was marketed 7968 tons of ore, which brought net returns of $202,182. This ore assayed gold, 0.24 oz.; silver, 46.22 oz.; lead, 3.73%, having an average gross value of $34.25 per ton. Smelting, freight, and sampling charges amounted to $8.88, making the average net value $25.37 per ton. The net profits for the period were $148,604. On July 1 there was a balance of $152,108 in the treasury. Development consisted of 1115 ft. of drifts and 149 ft. of winzes, or a total of 1264 feet.

Salt Lake County

Ohio Copper—The newly organized company still has a majority of Heinze directors on the board, but it is stated that the Allison interests will eventually have three of the five directors.

Bingham Amalgamated—The 1200-ft. Montana-Bingham tunnel which is being driven toward this ground is now within 50 ft. of Amalgamated lines.

Summit County

Park City shipments for the week ended Aug. 3 were: Silver King Coalition, 1,290,260; Daily West, 870,000; Daily-Judge, 567,000; Barry-Coxe, 51,000; total, 2,797,260 lb. For the week preceding 2,221,520 lb. were shipped. During July Park City shipments amounted to 7572 tons, which is an increase of 390 tons over June. The largest shippers

were the Silver King Coalition, Daly-Judge, and Daly West.

Daly-Judge—The quarterly report for the period ended June 30 has been issued. During the quarter 16,017 dry tons of concentrating ore was mined and 652 tons of shipping ore. There were 2785 tons of lead and 2250 tons of zinc concentrates produced. The former was valued at $36.72 per ton and the latter at $25.60. The net earnings as shown by the report were $77,201, which is in excess of the $45,000 dividend requirement. On July 1 there was a balance of $501,980 in the treasury.

Snake Creek Drain Tunnel—Trouble has been experienced here, on account of loose ground, which is considered dangerous by the men. They have demanded that it be timbered, refusing to work until this be done.

Ontario—There has been a delay in the arrival of machinery which is to be installed in the remodeled mill by the new leasing company.

Wisconsin

Platteville District

Betsy—A mill will be built at this mine on the John Weinschump farm, by J. H. Billingsley and associates.

Little Dad—A mill is being built of 50 tons capacity at this mine, adjoining the Kennedy mine to the south.

Wisconsin Zinc Co.—This company is removing the mill from the Drum to the East End mine, which it purchased recently. Shaft No. 2 has been started and a 10-in. well will be driven 500 ft. to supply milling water.

Schrier Mining Co.—This company is removing the mill to the old Sally Waters mine, which has recently been unwatered. Pitches to the southwest will be worked.

Lucky Five Mining Co.—This mine, at Dodgeville, has declared a second dividend this year of $70 per share; the first dividend of $100 was paid early in the year.

Dawson—After a long shut-down, work is being resumed at this mine, at Benton.

Vinegar Hill—This company is reopening the Brown-Croft mine, at Schullsburg. The company has also leased the adjoining Little Giant tract. The company has also started a new shaft on the Scrabble Creek property, at Hazel Green, which adjoins the Cleveland mine.

Hodge—Leases to this property have been renewed and operations will be resumed.

Highland Park—The main shaft will be cleaned out and prospecting commenced on this ground, formerly known as the West Empire.

Winskill—This mine, at Schullsburg, is one of the largest shippers in the district, as it produces from 250 to 300 tons per week.

Canada

British Columbia

Consolidated Mining & Smelting Co. of Canada, Ltd.—This company is preparing to make concentration tests with siliceous ores from the Le Roi mine, at Rossland. The equipment of the old Le Roi experimental mills is being added to. One unit of the Elmore vacuum process plant has been obtained from the Britannia Mining & Smelting Co.; Callow screens and a Wetherill separator have been removed from the Consolidated company's ore-testing plant at the St. Eugene mine, East Kootenay. There is in the Le Roi mine much low-grade siliceous ore, and it is with the object of reducing the siliceous contents to a percentage suitable for blast-furnace work that these tests are to be made.

Granby Consolidated—The following is a summary of the results of July operations: At the mine, 106,927 tons of ore was shipped in 28 working days, a daily average of 3960 tons; development work consisted of 539 ft. raising, 508 ft. drifting, 10 ft. sinking, and 1263 ft. diamond drilling. At the smeltery 1429 tons of ores other than from Granby mines were received; 107,427 tons of Granby and 1122 tons of foreign ores were smelted.

Ontario

Gosselin—The Hudson Bay Mining Co., of Cobalt, has secured an option on this mine, at West Shining Tree, at $250,000.

St. Anthony—This gold mine in western Ontario, is under option to the Canadian Mining & Exploration Co. It is extensively developed. Equipment to handle a tailings pile of about 15,000 tons will be installed soon.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Aug. 9, and for the year to date, are:

Beaver		219.75
Buffalo	31.50	798.44
Casey Cobalt		212.15
City of Cobalt		812.51
Cobalt Lake	32.85	466.21
Cobalt Townsite	30.50	954.81
Chamb.-Ferland		257.05
Coniagas	207.83	1,351.46
Crown Reserve		302.08
Drummond		330.30
Hudson Bay		440.06
Kerr Lake		444.14
La Rose	84.77	2,186.36
Lost and Found		15.00
McKinley-Darragh	68.51	1,701.99
Nipissing	113.82	1,444.38
O'Brien		345.62
Provincial		22.22
Right of Way		180.01
Timiskaming	31.85	713.08
Trethewey	29.35	312.89
Wettlaufer		229.04
Totals	631.11	13,699.68

Beaver—A stringer of high-grade ore has been found in developing No. 3 vein, at the 300-ft. level.

Penn-Canadian—This mine, formerly the Cobalt Central, has shipped 32 tons of ore. The old mill, with a capacity of 100 tons per day, is being refitted for the treatment of a large tonnage of low-grade ore now on the dump. The 305-ft. level is being developed for the working of a large block of milling ore.

Ontario—Porcupine

Crown Chartered—This property is being inspected by a Rochester engineer representing the New York State stockholders to determine their action as regards the payment of $35,000, which falls due this month. It is understood that a proposal for the sale of a controlling interest to Rochester men is under consideration.

Lucky Cross—Further good discoveries on this property in the Swastika district, are reported. Underground development has resulted in picking up veins traced on the surface and milling ore is being taken out. The plans for a 40-ton mill are completed and construction will be started soon.

Quebec

Buckingham—On account of the slackness of the market for graphite these mines have been closed down, throwing nearly 200 men out of work.

Mexico

Chihuahua

Cia. Minera La Republica—For the quarter ending June 30, 1912, operations at La Republica mines were as follows: Tons of ore crushed, 2107; production, 158,366 pesos; operating cost, 125,343 pesos; construction cost, 11,277 pesos. Labor conditions continue unfavorable, the revolution having drained this district of workers so that the mills cannot be kept supplied with ore.

El Oro

El Oro Mining & Ry. Co.—During July the mill was in operation 30 days, crushing 20,190 tons of ore and treating 14,840 tons of old tailings, the recovery as bullion being worth $169,420. The working expense was $99,100; the expenditure on development, $16,820, the mine profit, $53,500; the railway profit, $9170; the total profit, $62,670. The sum of $1770 was spent upon permanent mine improvement.

South America

Chile

Braden Copper Co.—Cable advices indicate that a high extraction is being obtained with the new Minerals Separation plant.

Peru

Aporoma Goldfields, Ltd.—The installation of monitors is nearly completed, the plant is in partial operation and is producing. Mr. Crane, the managing director, is about to leave for England.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Aug. 14—Demand for coal is on the increase in all parts of the country. There is a pronounced shortage of anthracite and operating companies are predicting an acute situation this winter.

The Western market has been rather slower than others in responding to the improved condition, but it has picked up considerably during the week. Prices are being more firmly held while buyers are now endeavoring to cover their requirement before a higher level is reached.

The Lake shipments have been fairly heavy but were curtailed to a certain extent by the congestion at head of the Lakes and the car shortage in the Eastern markets. Shipments to the Northwest have not been as large as was hoped for and it seems probable there will be a shortage there this winter.

Exports

Total exports of anthracite for June of the current year were 301,969 tons as compared with 340,664 tons for the same month last year; for the 12 months ended June 30 of the current year exports of anthracite amounted to 2,979,102 tons, as compared with 3,146,388 tons for the same period last year.

Bituminous exports for June of the current year, exclusive of bunker coal, amounted to 1,360,489 tons, as compared with 1,311,097 tons for the same month last year; for the 12 months ended June 30, bituminous exports were 14,709,847 tons, as compared with 11,839,099 tons for the same period last year. Bunker or fuel coal laden on vessels in the foreign trade during June of the current year totaled 567,162 tons, as compared with 586,183 for the same month last year.

Iron Trade Review

New York, Aug. 14—The United States Steel Corporation issued its eagerly awaited statement for July on Aug. 10. This shows unfilled tonnage as of July 31 as 5,957,079, as against 5,807,346 on June 30, and 5,733,983 on May 30. On July 31, 1911, the figure was 3,584,085, and has not been closely approached since Dec. 31, 1909, nor equalled since Sept. 30, 1907. A further advance in price on all grades is now being discussed.

The gain in unfilled tonnage of the United States Steel Corporation in July, 149,733 tons, reflects largely the reduced shipments in that month, shipments being probably 100,000 or 150,000 tons less than in June, which month showed a gain of 56,363 tons in unfilled tonnage, so that July bookings were probably slightly less than those of June. They were, however, almost up to capacity, and if, as is expected, they are larger this month than last, a further gain in unfilled tonnage will be shown, even though August shipments are as large as those of July.

The whole tone of the iron and steel market is one of increasing optimism, similar to that which obtained three years ago, during the memorable boom of 1909, when prices advanced after a great break. It is asserted by steel manufacturers that the present improvement is much more striking, in the confidence shown by buyers, and it is claimed also that the buying is for actual consumption, and not in large part for speculative purposes. This same statement, however, was made three years ago.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age,* show that on Aug. 1 there were 247 coke and anthracite stacks in blast, having a total daily production of 78,650 tons; a decrease of 2750 tons from July 1. The production in July was light, owing to weather and other causes. Making allowance for the charcoal furnaces, the total production of pig iron for the month of July was 2,437,625 long tons. Adding this to the official report for the first half of the year gives a total of 16,509,900 tons for the seven months ended July 31. Of this total approximately 12,242,400 tons, or 74.2% were made by steel-works furnaces.

Birmingham

August 12—Pig-iron prices in the Southern territory have advanced 50c. per ton and $12 per ton for No. 2 foundry, is the general quotation heard, delivery during the balance of the year. Already the suggestion has been made that $12.50 per ton will be reached before the end of the year and furnace companies here are not making a price for iron for the first half of the coming year. A report printed in the north is to the effect that Southern iron was being quoted at $13 per ton for No. 2 foundry, for delivery during the first half of the coming year. Prominent iron men here say that with iron approaching $12.50 per ton before the end of this year that $13 might be a quotation for the first quarter of 1913.

The sales of pig iron in this section are greater than the make right along, while there is a little better production in this section. Consequently there is continued reduction of the accumulated stocks of iron in the South, and barren yards can be looked for by the end of the year. The output in July showed an increase of about six thousand tons over the production the previous month and the same increase is looked for during the month of August. There has been some delay in the work on furnace repairing and furnaces which were already to have been in blast will hardly be ready for the torch for several days yet.

Basic iron commands a good price and there is demand for all this product being manufactured. The steel situation is strong. There is need for a steady operation of the steel-rail mills, the rolling mills handling steel and the steel wire plants. Good prices obtain for steel products and the indications point to the necessity of steady operation through the balance of the year. Though official verification is lacking, it is generally understood that the American Steel & Wire Co. will be ready to operate its new plant at Ensley, Ala., by the first of the coming year. Labor troubles at foundries and machine shops are still on; the places of strikers are being filled.

While the Baltimore Trust Co. was given the right to sell the collateral in its possession to secure the $330,000 in notes of the Alabama Consolidated company, it has not done so, and is understood to be holding off to see what the receivers and protective committees will do toward putting the organization on a sound basis.

Baltimore

Aug. 12—Exports for the week included 3,282,100 lb. steel rails and 89,250 lb. bolts and spikes to St. Johns, N. F.; 41,562,140 lb. steel billets and 286,540 lb. bars to Liverpool; 6,461,500 lb. steel rails and 547,040 lb. tie and angle plates to Tampico; 76,032 lb. of wire to Havana; and 73,601 lb. of pipe to Hamburg. Imports for the week included 50 tons of ferromanganese from Rotterdam; 6800 tons of manganese ore from Batoum; 18,500 tons of iron ore from Cuba; and 30 tons of spiegel and 2155 tons of ferromanganese from Middlesboro.

Chicago

Aug. 12—The market for pig iron has been quiet in the last week; that for finished products has continued active. Sales of pig iron have occasionally run over the 1000-ton mark, but in general the melters are buying small lots to cover their requirements for the last half, quotations on 1913 business being stiffly maintained by the furnace agents at something more than for last-half business. The sales that are being made are at $15.50, furnace—about $15.90, delivered—for No. 2 Northern foundry iron and $11.75@12, Birmingham—$16.10@16.35, Chicago—for No. 2 Southern. Most sales of Southern are made at the $12 figure, which has been standard for the last two or three weeks.

Furnace agents profess no uneasiness about the lack of activity; the furnaces, they say, are well sold up for the rest of the year and many melters have been buying so closely that there is a good deal of iron yet to be sold for last-quarter delivery. Inquiries on 1913 tonnage are numerous and occasionally indicate anxiety on the part of those in need of it. The strong outlook for business in all finished lines and for general business, in 1913, seems to justify optimism on the part of the furnace agents, despite the fact that some iron is being sold at a slight reduction from the $12, Birmingham, standard.

There is little business being done by local mills in products to be delivered this year, for the reason that they are under contract for practically all their 1912 output. Some first-quarter business is being done and the pressure for more increases with the the prospect of great crops and general prosperity. Railroad needs especially are heavy and no lessening of the heavy demand for all finished products appears in sight.

Philadelphia

Aug. 14—The chief difference between business conditions in pig iron now and a week ago is the evidence of anxiety among buyers as to prices. Within a few days the tone of the market has improved. Basic pig is urgently wanted, and large orders are hanging fire. Foundry iron has hardened over last week; No. 2, best makes, $16.25, with sales at $16. Gray pig ranges from $15.25@15.75. Southern forge is offered at $14.

Steel Billets—Requirements are increasing or at least are becoming more urgent. Several companies are again in the market, though two weeks ago they felt safe. The upward tendency in billets has aroused them to activity and a good business is in sight, especially in forging.

Bar Iron—Bars are strong and in jobbing lots an advance over last week is noted. A further advance is within reach on quick deliveries which are now more frequently asked for. Common iron is in urgent demand and car builders are covering their necessities promptly.

Sheets—All advices this week show a further accumulation of business at mills, particularly from the heavier consumers. In small lots, prices are a shade higher.

Pipes and Tubes—Merchant-pipe orders appear to be subsiding, only a scattering business has been done for a week. Tubes are strong and the recent advance has served to stimulate business.

Plates—Mills are much oversold. Recently presented requirements have not been adequately taken care of. Marine plate and tank have been unusually active and mills are considering some big orders for winter and early spring delivery. All large plate-using concerns have more or less business they would like to place and they are willing to contract at the present top-notch prices.

Structural Material—There is a steady influx of moderate-sized orders for building purposes and small bridge work.

Steel Rails—There is a steady run of orders, and mills are taken care of up to the end of the year with inquiries pending for large quantities. A large business has been done on export account.

Pittsburgh

Aug. 13—Crude steel has grown scarcer, and the Carnegie Steel Co. has again been a buyer in the open market, taking 1000 tons from a Philadelphia district producer, for shipment to the Pencoyd plant, with an option on 4000 tons more. The Carnegie Steel Co. is short of openhearth steel and may buy a considerable tonnage to apply on its contract to supply the bridge subsidiary of the Steel Corporation. Prices on both billets and sheet bars are quotably higher in this market.

Specifications for finished steel continue to be good and there is no evidence that buyers are accumulating any material for speculative purposes. There is inquiry for next year's delivery, particularly in rails and sheets, and 180,000 tons of rails are reported to have been sold already to Western roads for 1913 delivery.

Pig Iron—Foundry iron is quotable 50c. higher, there having been a number of relatively small purchases at $14, Valley furnaces, and extended inquiry in the past few days has failed to develop any lower quotation. Bessemer and basic are not easy to quote, as furnaces have been advancing prices, without sales at the higher ranges. It is quite certain, however, that there is no more basic to be had at $13.50, furnace, unless some new seller should appear in the field, and the market seems fairly quotable at not under $13.75, with most sellers asking $14 or $14.25. The supply of bessemer at $14.50 seems to be fairly well cleaned up. Two or three steel works were sounding the market on bessemer, but it is stated they have not bought because they insisted on shading $14.50. The Andrews & Hitchcock Iron Co. blew in its second furnace on Aug. 1, and the Kittanning Iron & Steel Co. blew in its Rebecca furnace about Aug. 10. Alice furnace, of the Valley Mold & Foundry Co., will likely blow in within a few weeks, also Mattie furnace at Girard and Josephine No. 2 at Josephine, Penn., the last named being a new furnace built by Corrigan, McKinney & Co., and not operated thus far. We quote: Bessemer, $14.50@14.75; basic, $13.75@14; No. 2 foundry, $14; malleable, $13.50@13.75; gray forge, $13.25@13.50.

Ferromanganese—The market has continued strong, with contract metal held at $51, Baltimore, freight to Pittsburgh being $1.95, and prompt material at about the same figure.

Steel—As noted, the Carnegie Steel Co. is a buyer of openhearth-steel billets to apply on its contract to supply the Pencoyd works of the American Bridge Co. In the local market the lowest price quoted on its inquiry was $23, maker's mill, but by buying in the East more than half the freight to Pencoyd was saved. The mills generally are out of the market as sellers, but odd lots can be picked up usually from brokers or from small mills, at material advances over prices quoted a week or two ago. We quote: Bessemer billets, $22.50; bessemer sheet bars, $23; openhearth billets, $23; openhearth sheet bars, $23.75@24, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are $25@26.

Sheets—Inquiry has begun to develop for the first quarter of next year, but the mills refuse to make commitments so far ahead, not knowing what their steel is going to cost even for the fourth quarter. Specifications have been accumulating with the mills for a long while, and this accumulation has probably been a little more rapid in the past few weeks on account of production being reduced 10 to 15% by weather conditions and the necessity for making repairs. At present about 85% of the sheet mills are active, and the proportion will likely run above above 90% within a fortnight. Prices have continued to stiffen, and the minimum of the market is now up to the prices announced by the leading interest several weeks ago. The Western market, long subject to particularly strenuous cutting, is now firm. Mills are certain that full production can be maintained through the year, which means that this year's tonnage output will surpass all records by a large margin. The market stands at 2.05c. for black sheets, 28-gage; 3.15c. for galvanized, 28-gage; 1.45@1.50c. for blue annealed, 10-gage; 2.20@2.25c. for painted corrugated, 28-

gage, and 3.10@3.20c. for galvanized corrugated, 28-gage.

Connellsville Coke—The Producers' Coke Co., in whose hands several of the operators placed their business after the recent split, reports making four or five contracts for furnace coke for the balance of the year, including one of 6000 tons a month, another of 5000 tons, and two or three smaller lots, in all aggregating 20,000 tons or more per month. This coke is understood to have all been sold at $2.25. Other sellers have disposed of 15,000 to 25,000 tons of prompt coke and coke for delivery the balance of this month, none at less than $2.25, and some at $2.30. Selling is now in full swing after the late unpleasantness between buyers and sellers, and higher prices are predicted as the coke becomes better sold up.

St. Louis

Aug. 12—Business among the founders has been good and while most of them were pretty well protected on their pig-iron supply they are now nearly all in the market augmenting their supply to some extent. Most of the current business is for small lots, though some fair-sized contracts for delivery further in the future have been closed. Prices for immediate delivery are around $11.50, Birmingham, or $15.25, St. Louis. For the fourth quarter $12, Birmingham, or $15.75, St. Louis, is being asked. Northern iron is quoted at $15.50@15.75.

Coke is in good demand, low sulphur foundry bringing from $5.30 to $5.50, St. Louis.

METAL MARKETS

New York, Aug. 14—The metal markets have been irregular during the last week. Copper has wabbled and recovered on small business, big business being absent. Spelter has turned weaker. Transactions in lead have been active at the lower level of price previously established. Tin has been stronger but not much business has been done in it.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January....	110	111	July.....	112	114
February..	115	109	August.....	117	.....
March.....	112	111	September.	111	.....
April.....	114	115	October....	112	.....
May.....	118	118	November.	111	.....
June.....	115	117	December..	110	.....

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London remained at the bank level, 77s. 6d. per oz. for bars and 76s. 4d. per oz. for American coin. India was the chief buyer.

Iridium—The price for pure metal remains at $63.50 per oz., New York.

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
June 1912..	$ 7,149,035	$ 5,611,057	Exp. $1,537,978
" 1911..	3,074,755	4,767,714	Imp. 1,692,959
Year 1912..	33,374,836	25,264,342	Exp. 8,110,494
" 1911..	13,251,562	33,773,026	Imp. 20,521,464
Silver			
June 1912..	5,045,944	4,879,485	Exp. 166,459
" 1911..	5,777,703	3,506,446	Exp. 2,271,257
Year 1912..	33,668,972	25,264,249	Exp. 8,404,723
" 1911..	34,443,203	21,960,601	Exp. 12,482,602

Exports from the port of New York, week ended Aug. 10: Gold, $25,000; silver, $1,345,371, chiefly to London. Imports: Gold, $664,128; silver, $181,607; from Mexico, Central and South America, and Japan.

Platinum—The market remains rather quiet, as consumers hope for materially lower prices, but there is no change. Dealers still ask $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Aug. 1, that the market is again characterized by the absence of demand. There appears to be a considerable stock of platinum at the local speculators, and the *staratelli,* the sole uncontrolled supply of platinum, are still offering metal. From the mines it is reported that the production this year is no greater than last. Officially the prices remain unchanged; i.e., St. Petersburg, $36.75 per oz.; Ekaterinburg, $36.85 per oz., for crude metal, 83% platinum.

SILVER AND STERLING EXCHANGE

Aug.	8	9	10	12	13	14
New York....	61	61	61¼	61⅛	61⅛	61¾
London	28 7/16	28 7/16	28 7/16	28⅛	28 7/16	28 7/16
Sterling Ex..	4.8725	4.8735	4.8735	4.8720	4.8710	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—Silver has had a sharp advance this week, closing steady at 28 7/16 pence in London.

The Indian Bazaars have been buyers and it is rumored that the Indian Mint is also in the market, which has also resulted in speculative buying.

Exports of silver from London to the East, Jan. 1 to Aug. 1, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£4,971,800	£4,240,200	D. £731,600
China..... ...	890,400	933,500	I. 43,100
Total.....	£5,862,200	£5,173,700	D. £688,500

Imports of silver into Great Britain six months ended Jupe 30 were £7,307,906, of which £5,900,135 came from the United States. Exports were £6,849,350; net imports, £458,556, which compares with net exports of £971,882 last year.

Imports of silver into France five months ended May 31 were 112,259,000 fr.; exports, 97,356,000 fr.; excess of imports, 14,903,000 fr., or 10,159,000 fr. less than last year.

Copper, Tin, Lead and Zinc

Copper—The market has continued very dull. Europe, feeding on its own stocks, does not buy anything to speak of; and American manufacturers do not buy anything more than they have to, which at present is very little. The diminution in the exports in August indicates that previous contracts to Europe are rapidly being filled and renewed buying ought to develop from there before long, but whether that will take the form of drafts upon home stocks or purchases from producers here is the question that many persons would like to forecast correctly.

NEW YORK

Aug.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
8	17½ @17¾	17.40 @17.50	45⅛	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80
9	17⅛ @17¾	17.30 @17.50	45¼	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80
10	17⅛ @17¾	17.30 @17.50	45⅛	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80
12	17⅛ @17¾	17.45 @17 50	45¾	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80
13	17⅛ @17¾	17.45 @17.50	45¾	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80
14	17⅛ @17¾	17.45 @17.50	46	4.50	4.35 @4.37½	6.85 @6.95	6.70 @6.80

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Aug.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
8	78 1/16	78 3/16	83¼	204¾	202½	19⅜	26¼
9	77¼	77¼	82½	205	203	19⅜	26¼
10	....	....	....	.....	.....	....	....
12	78⅛	78¼	83	207	204¾	19 7/16	26¼
13	78⅝	78⅝	83½	207	205	19⅜	26¼
14	79⅛	79	83¾	208	205¾	19⅜	26½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = ± 21¾c.

Four of the agencies here stand pat for their price asked—17¾c., delivered, usual terms. The others are willing to sell at 17⅝c. Some sales to Connecticut on that basis were made during the latter part of our week, but other offers at the same price failed to draw business. Rumors of sales at 17¾c., usual terms, have been industriously circulated, but such as have been made at that price have manifestly been either for non-competitive deliveries or under special conditions otherwise, inasmuch as copper has all along been liberally offered in the open market at 17⅝c.

Following the publication of the statistics on Aug. 8, the market became rather soft under lower offerings by speculative houses, the statistics being taken rather unfavorably, and some sales at surprising concessions have been talked about, but the publication of Mr. Ryan's optimistic views on Aug. 12, was reassuring and the market rallied.

The business in Lake copper during the last week was insignificant and quotations are but nominal.

At the close we quote Lake copper at 17½@17¾c., and electrolytic in cakes, wirebars and ingots at 17.45@17.50c. Casting copper is quoted nominally at 17¼@17⅜c. as an average for the week.

The Producers' Association figures for July made an unfavorable impression abroad and there was considerable bear selling, in consequence of which the London Standard market, which, on Aug. 8, was £78 1/8 for spot and £78 3/8 for three months, declined on Aug. 9 to £77¼—for spot and three months. However, on Monday, Aug. 12, some good buying made itself felt, and the market advanced to £78½—for both spot and three months positions. On Aug. 13 it advanced further to £78⅝, closed on Aug. 14 strong at £79⅛ for spot and £79 for three months.

Copper sheets are 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Copper exports from New York for the week were 4182 long tons. Our special correspondent gives the exports from Baltimore at 1727 long tons for the week.

Brass Prices—The American Brass Co. announces the following brass prices, dating from Aug. 1: Sheets, high brass, 18¼c. net per lb.; low brass, 20⅛c. Wire, high brass, 18c.; low brass, 20⅛c. Rods, high brass, 18c.; low brass, 20⅞c. Brass tubing, brazed, 22⅞c.; open-seam, 21¾c. Angles and channels, 22⅛c. Scrap allowances, 12¾c. net per lb. for high brass and 14⅛c. for low brass.

Tin—There has not been much business doing in this country, but the cables report large transactions in the East Indies, in consequence of which the London market has been strong and steadily advancing. In harmony therewith the American price has also advanced and at the close early delivery is quoted at 46 cents.

Tin imports from Aug. 1 to 12, inclusive, amount to 1953 tons.

Tin exports from the Straits in July were 4580 long tons, a decrease of 80 tons from July of last year.

Visible stocks of tin on Aug. 1 were: United States, excluding Pacific ports, 4412; London, 6799; Holland, 2743; total, 13,346 long tons, an increase of 426 tons over the July 1 statement.

Spelter—The market is weaker, inquiry having been light and all orders that presented themselves having been eagerly competed for. At the close, St. Louis is quoted at 6.70@6.80c., according to the time of delivery.

The foreign market is slightly higher, good ordinaries being quoted £26½, and specials 5s. higher.

Base price of zinc sheets is $8.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼@7⅜c. per lb. in carload lots, New York.

Lead—At the lower level of prices a good demand has developed and some substantial transactions have been made at 4.50c., New York, and about 4.35c., St. Louis.

The European market is practically bare of supplies. Spot metal is scarce, and there does not appear to be any relief in sight for some months to come. The market closes strong, with Spanish lead quoted at £19⅜ and English 2s. 6d. higher. Cables report that it looks as though the foreign market would advance still further.

Other Metals

Aluminum—There has been little demand during the last week. Dealers are asking 24¼@24½c. per lb. for No. 1 ingots, New York.

Antimony—Some large sales have been made recently and prices are good. Cookson's is held at 8.50@8.60c. per lb., Hallett's and U. S. at 7.90@8c., and Hungarian, Chinese and other outside brands at 7.70@7.80c. per lb. All prices are ex-dock, New York.

Nickel—Slot, blocks, plaquettes, according to quality, 40 to 45c. per lb. Electrolytic nickel, 3c. per lb. extra.

Quicksilver—Business is fair and prices here are unchanged. New York quotations are $42.50 per flask of 75 lb., with 60@62c. per lb. asked for retail lots. San Francisco, $42 for domestic orders and $39.50 for export. The London price is unchanged at £8 5s. per flask, with the same price named from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., Aug. 10—In spite of the est-back in spelter the base price paid for top grades of zinc ore was maintained at $59 to $60, due to the general shortage of ore supply. The base price paid for 80% lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED AUG. 10

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	635,840	.....	.....
Benton	567,740	86,800	760,300
Platteville	538,700	.....	188,500
Hazel Green	520,000	.....	.....
Shullsburg	380,000	.....	.....
Galena	271,500	275,700	.....
Highland	239,000	147,100	.....
Cuba City	145,060	64,230	124,020
Harker	64,620	.....	.....
Linden	61,880	.....	.....
Total	3,424,340	573,830	1,072,820
Year to date	125,202,320	5,755,120	20,251,190

Joplin, Mo., Aug. 10—The high price of zinc sulphide ore is $62, the base ranging from $53 to $59 per ton of 60% zinc. Zinc silicate sold on a base of $30 to $33 per ton of 40% zinc. The average price, all grades of zinc, is $55.42 per ton. The high offering for lead is $58, a base price of $56 to $57 per ton of 80% lead. The

SHIPMENTS, WEEK ENDED AUG. 10

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,968,060	.....	1,609,000	$162,548
Joplin	2,541,520	.....	247,910	81,190
Galena	913,690	.....	45,060	27,850
Miami	758,680	.....	77,230	23,140
Alba-Neck	602,900	.....	40,290	18,912
Duenweg	621,330	.....	27,540	17,787
Oronogo	482,070	.....	202,290	17,447
Granby	59,770	537,600	33,280	11,170
Cave Springs	370,000	.....	.....	10,730
Carl Junction	336,670	.....	11,520	10,445
Spurgeon	53,700	275,890	41,760	7,350
Jackson	192,840	.....	.....	6,690
Springfield	110,000	.....	.....	3,400
Aurora	.....	180,000	.....	2,700
Lawton	65,000	.....	.....	1,885
Carthage	67,100	.....	.....	1,811
Quapaw	65,000	.....	.....	1,690
Wentworth	64,210	.....	.....	1,669
Sarcoxie	63,650	.....	.....	1,664
Totals	11,336,190	993,490	2,337,680	$410,078
32 weeks	327,680,420	20,059,500	56,481,020	$10,363,210

Blende val., the week, $325,596; 32 weeks, $8,493,811
Calamine, the week, 16,155; 32 weeks, 301,887
Lead value, the week, 68,327; 32 weeks, 1,567,512

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	55.88	38.18	54.38	56.49	55.01
July	40.75	58.85	38.36	56.59	58.81	58.83
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.27	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore: the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

average price, all grades of lead, is $58.44 per ton.

Both zinc and lead offerings were $2 per ton less than last week, with zinc $3 to $4 per ton weaker at the week-end. Until within the past fortnight little ore in the bins at the week-end was unsold, but the small stock on hand tonight is held for a stronger offering.

Chemicals

New York, Aug 14—The general market is quiet, with only a midsummer business forward.

Arsenic—The market has been affected again by Mexican disturbances, and is now at 5c. per lb. for spot goods. Neither Canadian nor American producers seem willing to enter the market, and importation from England is still going on. Futures are at 4@4¼c. per pound.

Copper Sulphate—The market is dull at 5.50 for large lots to 5.75c. for small.

Nitrate of Soda—Prices have been marked up on spot goods, and now stand at 2.50c. in all positions. The market is dull, but firm.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, six months ended June 30:

	Imports	Exports	Excess
Copper sulph. lb.	.....	10,225,875 E.	10,225,875
Copper sul., '11	.....	8,936,676 E.	8,936,676
Bleach, lb.	34,960,712	400 I.	34,960,712
Bleach, 1911	45,083,158	17,368 I.	45,065,790
Potash salts, lb.	318,749,519	1,698,559 I.	317,050,960
Potash salts, '11	365,666,526	2,138,268 I.	363,528,258
Soda salts, lb.	5,995,878	249,415 I.	5,746,463
Soda salts, 1911	16,065,417	287,535 I.	15,777,882
Acetate lime, lb.	.....	36,384,105 E.	36,384,105
Acetate, 1911	.....	40,454,433 E.	40,454,433
Nit. of soda, tons	255,447	5,118 I.	250,329
Nitrate, 1911	319,575	3,435 I.	316,140
Phosphates, tons	.....	583,921 E.	583,921
Phosphates, '11	.....	519,407 E.	519,407
Sulphur, tons	12,049	21,498 E.	9,449
Sulphur, 1911	10,902	4,838 I.	6,064
Pyrites, tons	472,973	..... E.	472,973
Pyrites, 1911	485,620	..... E.	485,620
Magnesite, lb.	100,002,925	917,532 I.	99,085,393
Magnesite, 1911	131,944,309	1,371,105 I.	130,573,204
Sul. ammonia, lb.	51,611,003	134,715 I.	51,476,288
Sul. am'nia, '11	92,753,624	..... I.	92,753,624
Arsenic, lb.	2,181,961	850 I.	2,181,111
Arsenic, 1911	2,480,074	3,000 I.	2,477,074

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 201,238 tons.

Petroleum

The monthly report of the *Oil City Derrick* shows new oil wells completed in July as follows: New York, Pennsylvania and West Virginia, 500; Lima-Indiana, 58; Kentucky, 8; Illinois, 14; Kansas-Oklahoma, 153; Texas-Louisiana, 100. In all the divisions there were 1439 wells completed, being 75 less than in June. New production amounted to 54,997 barrels, a decrease of 3987 barrels from the June report. Dry holes numbered 240, and gas wells were 107. The productive oil wells were 1092, as against 1148 in June, and 981 in May. At the close of July there were 514 rigs and 1474 wells drilling, a total of 1988, increase of 86. The increase comes from all divisions except the Lima fields.

Mining Stocks

New York, Aug. 14—On Aug. 8 there was a slight reaction on the Exchange, followed by some recovery on small dealing. The Curb was dull, dealings in mining stocks being small and uninteresting.

Aug. 9 was generally devoted to marking time, while waiting for the government's crop report, although some specialties made new high records.

Aug. 10 the Exchange opened strong and active, and after some realizing sales by professionals, who were unwilling to hold commitments open over Sunday, closed the same way with prospects of a continuance of the upward movement on Monday. On the Curb, the market was also active, Standard Oil being the feature.

On Aug. 12, the prices continued good, reflecting the favorable report of the Steel Corporation. The Standard Oil group was again the feature of the Curb, Atlantic Refining Co. advancing 50 points, Galena Signal Oil, 30 points and Standard of Kansas, 80 points.

Aug. 13 was without special feature on the Exchange, for trading was evenly distributed, and fractional changes were the rule. On the Curb, 34,400 mining shares were sold, of which West End Extension furnished 10,500, and El Paso 4200.

Boston, Aug. 13—A trifle more public interest is noted in the metal-share market, yet there is plenty of room for improvement in this direction. Any aggressive buying would give copper shares a sharp advance, but there is an entire lack of leadership, which coupled with the fact that mid-summer usually finds dullness, gives the market a colorless appearance except in the case of some specialties.

Both Mayflower and Old Colony have resumed marked activity during the past two days. The $1.62½ rise in Mayflower shares on Monday and the $2.62½ advance today to $15.25 came from information that the No. 20 drill is in rich copper and makes the best showing yet. This is between the depths of 982 and 1029 ft. Old Colony rose $1.25 yesterday and $1.62½ today, touching $11.12½. Today's advance was accompanied by reports that the No. 16 hole had encountered the Mayflower lode.

Some inspiration is being derived from these advances, for the same specialties gave the copper-share market the required fillip for a fair-sized boom back in April. Shannon Copper directors have declared the expected 50c. dividend, but this had been discounted. The last payment was made in 1907. The company reports an excess of assets of $567,836

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	May	June	July
Alaska shipments.	1,720,391	4,134,569	.....
Anaconda	25,800,000	.....	.....
Arizona, Ltd.	3,500,000	3,300,000	3,200,000
Copper Queen	7,024,087	7,622,730	7,708,147
Calumet & Ariz.	4,424,000	4,160,000	4,748,000
Chino	1,275,850	1,474,979	2,945,000
Detroit	2,092,478	1,959,634	2,194,090
East Butte	1,445,000	.....	.....
Mammoth	1,760,000	.....	.....
Mason Valley	1,520,000	1,500,000	1,500,000
Nevada Con.	6,063,462	5,913,832	.....
Ohio	685,000	.....	.....
Old Dominion	2,180,000	2,130,000	.....
Ray	2,924,913	3,004,195	2,985,965
Shannon	1,464,000	1,270,000	1,446,000
South Utah	236,884	.....	.....
United Verde*	2,500,000	.....	.....
Utah Copper Co.	9,564,919	8,772,742	.....
Lake Superior*	21,250,000	15,600,000	19,500,000
Non-rep. mines*	8,400,000	8,300,000	8,970,000
Total production.	105,830,984	.....	.....
Imports, bars, etc.	25,836,519	24,262,292	.....
Total blister	131,697,503	.....	.....
Imp. in ore & matte	6,410,226	8,404,936	.....
Total American.	138,107,729	.....	.....
Miami†	2,676,702	2,683,310	3,027,710
Brit. Col. Cos.:			
British Col. Copper	875,000	996,000	1,026,000
Granby	1,914,460	1,888,400	.....
Mexican Cos.:			
Boleo†	2,260,160	1,851 920	2,386,480
Cananea	4,600,000	4,310,000	4,000,000
Moctezuma	2,892,521	3,176,819	3,094,016
Other Foreign:			
Cape Cop., S. Africa	754,880	.....	.....
Kyshtim, Russia	.....	.....	.....
Spassky, Russia	694,400	757,120	.....
Famatina, Argen.	.....	.....	.....
Tilt Cove, Newf'd.	123,087	.....	.....
Exports from:			
Chile	3,696,000	9,856,000	.....
Australia	7,840,000	8,176,000	.....
Arrivals in Europe‡	9,976,860	12,667,200	.....

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	U.S. Refin'y Product'n	Deliveries, Domestic	Deliveries for Export
VII, 1911	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650
VII	137,161,129	71,094,381	60,121,331

VISIBLE STOCKS

	United States	Europe	Total
VIII, 1911	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,380
IV	62,367,557	136,819,200	199,186,754
V	65,066,029	134,176,000	199,242,689
VI	49,615,643	117,801,600	167,417,232
VII	44,335,004	108,186,000	152,521,047
VIII	50,280,421	113,299,200	163,579,621

over liabilities as of Aug. 13. St. Mary's Mineral Land has also shown some animation, advancing $1 to $56.

Trading has been quiet on the Curb and price changes moderate. Butte Central has been a trifle more active of late, advancing 75c. to $7.75.

Assessments

Company	Delinq	Sale	Amt
Belcher, Nev	Aug. 15	Aug. 30	$0.10
Belmont, Ida	July 22	Aug. 22	0.002
Black Pine M. & M., Utah	Aug. 29	Sept. 19	0.00½
Confidence, Nev	July 15	Aug. 9	0.20½
Con. Imperial, Nev	July 28	Aug. 21	0.01
Con. Virginia, Nev	Aug. 11	Sept. 5	0.20
Conqueror, Ida	July 20	Aug. 10	0.001½
Dalmatia, Ida	Aug. 24	Sept. 21	0.002
Dennemora, Ida	July 20	Aug. 20	0.002
Eagle Mt., Ida	July 31	Aug. 22	0.00½
Gould & Curry, Nev	July 19	Aug. 12	0.05
Horseshoe Ida	Aug. 8	Aug. 30	0.002
Hypotheek, Ida	July 19	Aug. 14	0.005
Laclede, Ida	Aug. 1	Aug. 24	0.003
Lone Star, Nev	July 20		0.02
Manhattan Red Top, Nev	July 12		0.01½
Mineral Farm, Ida	July 15	Aug. 15	0.002
Mineral Hill, Nev	Aug. 5	Oct. 5	0.01
National Copper, Ida	July 15	Aug. 15	0.01
New Reliance, S. Dak			0.01
Oreano, Ida	July 18	Aug. 19	0.001
Sandstorm-Kendall, Nev	July 8		0.01
Seven Troughs Mon'h, Utah	Aug. 10	Aug. 30	0.01
Silver Mt., Ida	July 15	Aug. 15	0.002
Springfield, Ida	July 30	Aug. 31	0.002
Tonopah North Star, Nev	July 15		0.02
Twin Star, Ida	Aug. 31	Sept. 28	0.02
Yellow Jacket, Nev	July 4	Aug. 12	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171		24.428	24.082	
September	53.295	52.440		24.567	24.209	
October	55.490	53.340		25.596	24.594	
November	55.635	55.719		25.680	25.649	
December	54.428	54.905		25.160	25.349	
Year	53.486	53.304		24.670	24.592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	17.190	12.720	17.353	56.673	76.636
August	12.405		12.634		56.266	
September	12.201		12.508		55.253	
October	12.189		12.370		55.170	
November	12.616		12.769		57.253	
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	44.519
February	41.614	42.962	August	43.319	
March	40.157	42.577	September	39.755	
April	42.185	43.923	October	41.185	
May	43.115	46.053	November	43.125	
June	44.606	45.815	December	44.655	
			Av. Year	42.281	

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	4.392	4.292	4.321	13.260	17.588
July	4.499	4.720	4.397	4.603	13.530	18.544
August	4.500		4.406		14.260	
September	4.485		4.356		14.744	
October	4.265		4.139		15.332	
November	4.298		4.181		15.821	
December	4.450		4.332		15.648	
Year	4.420		4.286		13.970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	7.116	5.545	6.966	25.006	26.174
August	5.953		5.803		26.801	
September	5.869		5.719		27.750	
October	6.102		5.951		27.256	
November	6.380		6.223		26.795	
December	6.301		6.151		26.849	
Year	5.758		5.608		25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	15.15	14.03	14.38	14.53	14.38
August	15.90		14.00		14.47	
September	15.90		13.57		14.40	
October	15.43		13.44		14.34	
November	14.92		13.30		14.25	
December	15.15		13.10		13.90	
Year	$15.72		$13.94		$14.49	

STOCK QUOTATIONS

COLO. SPRINGS Aug. 13

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con.	.01½
C. K. & N.	.17½
Doctor Jack Pot	.07
Elkton Con.	.71
El Paso	1.18½
Findlay	.06½
Gold Dollar	.18½
Gold Sovereign	‡.03
Isabella	.16½
Jack Pot	.05½
Jennie Sample	.05½
Lexington	.008
Moon Anchor	.008
Old Gold	.04½
Mary McKinney	.71
Pharmacist	.01½
Portland	.94
Vindicator	.89
Work	.01½

SALT LAKE Aug. 13

Name of Comp.	Bid.
Beck Tunnel	.08½
Black Jack	.13½
Cedar Talisman	.01¾
Colorado Mining	.21
Columbus Con	‡.35
Crown Point	.02½
Daly-Judge	5.80
Grand Central	.30
Iron Blossom	1.25
Little Bell	‡.35
Lower Mammoth	.04
Mason Valley	12.00
May Day	.16
Nevada Hills	‡1.90
New York	‡.01½
Prince Con	1.52½
Silver King Coal'n	2.80
Sioux Con	.04¾
Uncle Sam	.16
Yankee	.10

TORONTO Aug. 13

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.25	Hollinger	12.25
Hudson Bay	‡69.00	Imperial	.02
Temiskaming	.37	Pearl Lake	.17
Wettlaufer-Lor	.44	Porcu. Gold	.27
Apex	.02	Porcu. Tisdale	.01
Central	‡5.56	Preston E. D.	.02
Crown Chartered	.08	Rea	.25
Dobie	.30	Standard	‡.00⅝
Dome Exten	.14	Swastika	.09
Foley O'Brien	.18	West Dome	.05

SAN FRANCISCO Aug. 13

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	9.50
Belcher	.37	Jim Butler	.65
Best & Belcher	.09	MacNamara	.25
Caledonia	1.30	Midway	.58
Challenge Con	.14	Mont.-Tonopah	2.10
Chollar	.12	North Star	.17
Confidence	.70	West End Con	1.72½
Con. Virginia	.56	Atlanta	.28
Crown Point	.40	Booth	.07
Gould & Curry	‡.05	C.O.D. Con	.11
Hale & Norcross	.13	Comb. Frac	.16
Mexican	2.72½	Jumbo Extension	.41
Occidental	.50	Pitts.-Silver Peak	‡.98
Ophir	1.02½	Silver Pick	.11
Overman	.63	St. Ives	‡.30
Potosi	.03	Tramp Con	‡.02
Savage	.10	Argonaut	‡2.00
Sierra Nevada	.19	Bunker Hill	‡4.50
Union Con	.62	Cent. Eureka	‡.40
Yellow Jacket	.53	So. Eureka	‡2.90

N. Y. EXCH. Aug. 13

Name of Comp.	Clg.
Amalgamated	85¼
Am. Agri. Chem	60¾
Am.Sm.&Ref.,com	86⅛
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	87
Anaconda	43⅜
Batopilas Min	‡1⅝
BethlehemSteelpf	71⅝
Chino	34½
Comstock Tunnel	‡.10½
Federal M. &S., pf.	43½
Goldfield Con	3¾
GreatNor.,ore,.ctf.	44½
Guggen. Exp	‡56¾
Homestake	96
Inspiration Con	19
Miami Copper	29¾
Nat'nalLead,com.	‡59
National Lead, pf.	209½
Nev. Consol	21⅞
Pittsburg Coal, pf.	99
Ray Con	21
RepublicI&S,com.	28
Republic I & S, pf.	89½
SlossSheffi'd,com.	57⅞
Sloss Sheffield, pf.	102
Tennessee Copper	42⅝
Utah Copper	63
U. S. Steel, com	73
U. S. Steel, pf.	112⅞
Va. Car. Chem	48½

BOSTON EXCH. Aug. 13

Name of Comp.	Clg.
Adventure	8½
Ahmeek	350
Algomah	6⅝
Allouez	46
Am. Zinc	30⅞
Ariz. Com., ctfs.	5¼
Bonanza	‡.40
Boston & Corbin	7¼
Butte & Balak	3¾
Calumet & Ariz	77
Calumet & Hecla	535
Centennial	23
Con. Mercur	‡.03
Copper Range	59
Daly West	5¼
East Butte	14
Franklin	11½
Granby	54⅜
Hancock	29½
Hedley Gold	‡17
Helvetia	1¼
Indiana	19⅜
Island Cr'k, com	‡56
Island Cr'k, pfd	‡91
Isle Royale	35¾
Keweenaw	‡1½
Lake	36½
La Salle	6¾
Mass	14⅞
Michigan	2½
Mohawk	69¼
New Arcadian	4½
New Idria Quick	‡6⅞
North Butte	30¾
North Lake	‡6
Ojibway	4
Old Dominion	58¼
Osceola	117
Quincy	93½
Shannon	17½
Shattuck-Ariz	‡20
Superior	46¾
Superior & Bost	1
Tamarack	44
Trinity	6¼
Tuolumne	3
U. S. Smelting	46
U. S. Smelt'g, pf.	50
Utah Apex	‡1¼
Utah Con	11
Victoria	2½
Winona	6
Wolverine	109
Wyandot	2½

N. Y. CURB Aug. 13

Name of Comp.	Clg.
Barnes King	‡.40
Beaver Con	.45
Braden Copper	6¾
B. C. Copper	5
Buffalo Mines	1.50
Caledonia	.40
Con. Ariz. Sm.	⅝
Davis-Daly	2⅜
Diam'field-Daisy	9
Ely Con	.22
Florence	.94
Giroux	5⅛
Gold Hill Con	⅜
Greene Cananea	10⅛
Greenwater	.05
Internat. S. & R.	‡124
Kerr Lake	2⅞
Keystone	2¾
La Rose	3¼
McKinley-Dar-Sa	1⅛
Min. Co. of A. new	2¼
Motherlode Gold	1
Nev. Utah M. & S.	‡.02
Nipissing Mines	7¾
Ohio Copper	⅞
Pacific Sm. & M	⅛
South Live Oak	2
South Utah M. &S.	⅝
Standard Oil (Old)	1055
Stand'd Oil of N.J.	415
Stand'd Oil Subs.	640
Stewart	1⅞
Tonopah	6⅞
Tonopah Ex	2⅛
Tri-Bullion	⅛
Tularosa	¾
Union Mines	⅛
United Cop., pfd.	10
Yukon Gold	3⅛

BOSTON CURB Aug. 13

Name of Comp.	Last
Bingham Mines	3½
Boston Ely	1⅛
Boswycocolo	.04½
Butte Central	7⅛
Cactus	.12
Calaveras	2½
Chief Cons	1⅛
Corbin	.97
Cortez	1⅛
Crown Reserve	3½
First Nat. Cop	2
Majestic	.46
Mazatan	1½
Moneta Porc	‡.05
Nevada-Douglas	3⅜
New Baltic	3⅜
Oneco	1⅞
Raven Copper	.31
Rhode Island Coal	20
San Antonio	‡3
S. W. Miami	5
South Lake	9½
Trethewey	.40
United Verde Ext.	.40
Vulture	‡5

LONDON Aug. 14

Name of Com	Clg.
Camp Bird	£1 8s 3d
Dolores	1 10 0
El Oro	0 14 6
Esperanza	1 8 9
Mexico Mines	7 2 6
Oroville	0 5 3
Stratton'sInd.	0 3 1½
Tomboy	1 5 6

‡Last quotation.